		Name					Start	Finish		M&S EQ	M&S Labor	FNAL Labor	Total Cost
.2	Notes	Run IIb Trigge	er Upgrade)			11/1/01	3/16/05	\$1	,429,918	\$1,308,600	\$98,203	\$2,836,721
	WBS D The Let trigger, firmwar	efinition- vel 1 trigger upgrade a calorimeter cluste	r track match	at Level 1, a	nd the Level 1 cer	ntral track trigg	er. Procuremen	t of additional Lev	el 2 beta	processors, silic	on track trigger ele	ctronics boards, as	ems - the Level 1 calorime sociated hardware, and id initially commission the
.2.1	Notes	Level 1 Calori	imeter Trig	ger			1/2/02	2/7/05	\$	456,521	\$921,727	\$6,680	\$1,384,928
	WBS D This su	efinition- mmary element cove the provision of outp											nt of trigger-algorithm boa abling, and controls
.2.1.1		ADC/Digital F	ilter (ADF)				1/2/02	12/8/04	\$	\$229,302	\$526,646	\$0	\$755,948
	This su Risk Mi Risk of the des	ign (prototype desig	cost due to unt	foreseen des ed). Cost ris	ign changes is mi sk from extra labor	tigated by the	relatively large	contingency assig	ned to the	e procurement o	f components and f		y given the advanced sta contributions from Saclay
.2.1.1.1	Extra S	Design prototy		tne project	snould the need a	arise.	1/2/02	11/22/02		\$0	\$189,656	\$0	\$189,656
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost		Ovt. Work	Baseline Wor	. ,	Rem. Work	4 .00,000
	4 15	ElecEngU MandS	100% 189,655.6	\$0 \$189,656		\$0 \$189,656		1,840 h 189,655.6	0 h		0 h 1,472 h 0 151,724.48	368 h 37,931.12	
	Notes WBS D	efinition-											
	WBS D Design M&S B	a 16- or 32-channel		J	·	it, output and	control connecti	ons.					
	WBS D Design M&S B 1840 h	a 16- or 32-channel OE- of Saclay engineer	at \$4122.95/w	= \$189,655.	60								
.2.1.1.2	WBS D Design M&S B 1840 h	a 16- or 32-channel OE- of Saclay engineer a	at \$4122.95/w	= \$189,655.	60					\$0	\$15,110	\$0	\$15.110
.2.1.1.2	WBS D Design M&S B 1840 h	a 16- or 32-channel OE- of Saclay engineer a 3OE- on effort expended o	at \$4122.95/w	= \$189,655.	60		otype is almost o	entirely complete.		\$0 Baseline Work	. ,	\$0 em. Work	\$15,110
.2.1.1.2	WBS D Design M&S B 1840 h Labor E Based	a 16- or 32-channel OE- of Saclay engineer a BOE- on effort expended o Layout prototy	on the project	= \$189,655. so far. Note	60 that the design of	the ADF prot	otype is almost o	entirely complete. 1/2/03		* -	. ,	* -	\$15,110
.2.1.1.2	WBS D Design M&S B 1840 h Labor E Based c	a 16- or 32-channel OE- of Saclay engineer a 3OE- on effort expended o Layout prototy Resource Name ElecTechU	at \$4122.95/w on the project pe ADF Units 100% 15,110.4	= \$189,655. so far. Note	that the design of Baseline Cost \$0	the ADF prot	otype is almost of 10/28/02 Rem. Cost \$0	entirely complete. 1/2/03 Work Ovt. 320 h	Work	Baseline Work 0 h	Act. Work Re	em. Work 320 h	\$15,110
.2.1.1.2	WBS D Design M&S B 1840 h Labor E Based of the second of	a 16- or 32-channel OE- of Saclay engineer a BOE- on effort expended o Layout prototy Resource Name ElecTechU MandS refinition- prototype ADC boar	on the project pe ADF Units 100% 15,110.4	= \$189,655. so far. Note Cost \$0 \$15,110	that the design of Baseline Cost \$0 \$0	the ADF prot	otype is almost of 10/28/02 Rem. Cost \$0	entirely complete. 1/2/03 Work Ovt. 320 h	Work	Baseline Work 0 h	Act. Work Re	em. Work 320 h	\$15,110
.2.1.1.2	WBS D Design M&S B 1840 h Labor E Based of the second of	a 16- or 32-channel OE- of Saclay engineer a BOE- on effort expended of Layout prototy Resource Name ElecTechU MandS refinition- prototype ADC boar OE- of Saclay engineer at	at \$4122.95/w on the project pe ADF Units 100% 15,110.4 rds	= \$189,655. so far. Note Cost \$0 \$15,110	that the design of Baseline Cost \$0 \$0	Act. Cost \$0 \$0	10/28/02 Rem. Cost \$0 \$15,110	1/2/03 Work Ovt. 320 h 15,110.4	Work 0 h	Baseline Work 0 h 0	Act. Work Re	em. Work 320 h 15,110.4	
	WBS D Design M&S B 1840 h Labor E Based of the second of	a 16- or 32-channel OE- of Saclay engineer a 3OE- on effort expended o Layout prototy Resource Name ElecTechU MandS refinition- prototype ADC boar OE- of Saclay engineer at 3OE-	at \$4122.95/w on the project pe ADF Units 100% 15,110.4 rds t \$1888.80/w =	= \$189,655. so far. Note Cost \$0 \$15,110 = \$15,110.40 e current des	that the design of Baseline Cost \$0 \$0	Act. Cost \$0 \$0	10/28/02 Rem. Cost \$0 \$15,110	1/2/03 Work Ovt. 320 h 15,110.4	Work 0 h	Baseline Work 0 h 0	Act. Work Re	em. Work 320 h 15,110.4	
1.2.1.1.2	WBS D Design M&S B 1840 h Labor E Based of the second of	a 16- or 32-channel OE- of Saclay engineer a BOE- on effort expended of Layout prototy Resource Name ElecTechU MandS refinition- prototype ADC boar OE- of Saclay engineer at BOE- te from lead engineer	at \$4122.95/w on the project pe ADF Units 100% 15,110.4 rds t \$1888.80/w =	= \$189,655. so far. Note Cost \$0 \$15,110 = \$15,110.40 e current des	that the design of Baseline Cost \$0 \$0	Act. Cost \$0 \$0	n the time needs	entirely complete. 1/2/03 Work Ovt. 320 h 15,110.4	Work 0 h	Baseline Work 0 h 0	Act. Work Ri 0 h 0 the STT system (4 \$7,555	em. Work 320 h 15,110.4 weeks for the Fiber	· Road Card - FRC).
	WBS D Design M&S B: 1840 h Labor E Based d: 15 Notes: WBS D Layout M&S B: 320 h c Labor E Estimat	a 16- or 32-channel OE- of Saclay engineer a 3OE- on effort expended of Layout prototy Resource Name ElecTechU MandS refinition- prototype ADC boar OE- of Saclay engineer at 3OE- te from lead engineer Fabricate/Asse	on the project pe ADF Units 100% 15,110.4 rds t \$1888.80/w =	= \$189,655. so far. Note Cost \$0 \$15,110 = \$15,110.40 e current des	that the design of Baseline Cost \$0 \$0 \$0	Act. Cost \$0 \$0	10/28/02 Rem. Cost \$0 \$15,110	entirely complete. 1/2/03 Work Ovt. 320 h 15,110.4 ed to lay out board 2/28/03	Work 0 h	Baseline Work 0 h 0 ar complexity in \$52,500	Act. Work Ri 0 h 0 the STT system (4 \$7,555	em. Work 320 h 15,110.4 weeks for the Fiber \$0	· Road Card - FRC).

WBS Name Start Finish M&S EQ M&S Labor FNAL Labor Total Cost

"Fabricate/Assemble Prototype ADF" continued

Notes

Fabricate 5 prototype cards.

M&S BOF-

\$52,500 for equipment (assumes prototypes are ~10x the cost of the production versions) plus

160 h Saclay technician at \$1888.80/w = \$7,555.20

total = \$60,055.20

Labor BOE-

Based on the Fab/Assembly time for the STT FRC (4 weeks). Multiplied by a factor of two to take into account increased board complexity.

1.2.1.1.4 \$0 2/3/03 5/2/03 \$5.000 \$15,632 \$20,632 Bench Test Prototype ADF Resource Name Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work ElecEngU 20% \$0 \$0 \$0 \$0 104 h 0 h 0 h 0 h 104 h 8 ElecTechU 20% \$0 \$0 \$0 \$0 104 h 0 h 0 h 0 h 104 h \$0 \$0 10 **PhysicistU** 30% \$0 \$0 156 h 0 h 0 h 0 h 156 h 15 MandS 20,632.24 \$20,632 \$0 \$0 \$20,632 20,632.24 0 20,632.24

Notes

WBS Definition-

Test on test stand with simulated input signals.

M&S BOE-

\$5,000 for test equipment (see cost book for details) plus

104 h Saclay engineer at \$4122.95/w = \$10,719.66 plus

104 h Saclay technician at \$1888.80/w = \$4,910.88

total = \$20.630.54

1.2.1.1.5 Prototype L1 Calorimeter Trigger ADF Shipped To

5/2/03

3/1/02

5/2/03

3/28/02

\$0

\$0

\$0

\$16.494

\$0

\$0

\$0

\$16.494

Notes

WBS Definition-

milestone: at least one prototype shipped to Fermilab for in-situ tests

1.2.1.1.6 Design analog splitter

		•									
ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
4	ElecEngU	100%	\$0	\$0	\$0	\$0	160 h	0 h	0 h	160 h	0 h
15	MandS	16,494.4	\$16,494	\$0	\$16,494	\$0	16,494.4		0	16,494.4	0

Notes

WBS Definition-

This element is an active device that takes as input a number of differential analog signals coming from the BLS cards, and produces two identical copies of these signals. One copy feeds the trigger system in place (CTFE board) while the second copy is to be connected to the prototype ADF. The board accomodates 8 channels, i.e. 4 trigger towers. All channels are identical and comprises 3 fully-differential amplifiers and passive components. The complexity of the board is rather low.

M&S BOE-

160 h Saclay engineer at \$4122.95/w = \$16,491.79

Labor BOE-

Design finished.

1.2.1.1.7 7/1/02 8/26/02 \$1,595 \$7,555 \$0 \$9,150 Layout and fabricate analog splitter Units Work Ovt. Work Baseline Work Act. Work Rem. Work ID Resource Name Cost Baseline Cost Act. Cost Rem. Cost ElecTechU 50% \$0 \$0 \$0 \$0 160 h 0 h 0 h 160 h 0 h 15 \$0 \$0 9,150.2 9,150.2 MandS 9,150.2 \$9,150 \$9,150 0 0

Notes

WBS Definition-

Layout and fabrication of Splitter cards.

M&S BOE-

WBS Name Start Finish M&S EQ M&S Labor FNAL Labor Total Cost

"Layout and fabricate analog splitter" continued

Notes

\$1595 for components and fab costs (see cost book for details)

160 h Saclay technician at \$1888.80/w = \$7,555.20

total = \$9,150.20

Labor BOE-

Estimate from lead engineer based on completed design of the splitter card.

1.2.1.1.8 Bench test analog splitter 9/4/02 9/17/02 \$0 \$1,889 \$0 \$1,889

Ovt. Work Rem. Work Resource Name Baseline Cost Act. Cost Rem. Cost Work Baseline Work Act. Work ElecTechU 8 50% \$0 \$0 \$0 \$0 40 h 0 h 0 h 40 h 0 h 15 MandS 1,888.8 \$1,889 \$0 \$1,889 \$0 1,888.8 1,888.8

Notes

WBS Definition-

Test of Splitter cards to verify basic functionality and to ensure that split signals are not degraded. Tests on a per channel basis include measurements of: gain vs frequency, dynamic range and temporal response under the expected input pulse shape.

M&S BOE-

40 h Saclay technician at \$1888.80/w = \$1,888.80

Labor BOE-

Estimate of lead engineer based on his experience with similar, simple boards.

1.2.1.1.9 Design SCL interface 7/15/02 9/23/02 \$0 \$41,236 \$0 \$41,236

ID Resource Name Work Ovt. Work Rem. Work Units Cost Baseline Cost Act. Cost Rem. Cost Baseline Work Act. Work ElecEngU 400 h 100% 360 h 40 h \$0 \$0 \$0 \$0 0 h 0 h 15 MandS 41,236 \$41,236 \$0 \$41,236 \$0 41,236 37,112.4 4,123.6 0

Notes

WBS Definition-

This element is in charge of distributing timing signals to the ADF system and provides a path to distibute fast synchronous signals within the ADF system. The board includes a SCL mezzanine receiver card and is linked to each ADF crate via a medium speed cable (~64 Mbit/s). A single FPGA and additional logic (e.g. digital delay lines) are used on that board; No slow control interface is needed because all parameters are static. This board is of moderate complexity.

M&S BOE-

400 h Saclay engineer at \$4122.95/w = \$41,229.48

Labor BOF-

Estimate of lead engineer based on discussions with the people who designed the SCL.

1.2.1.1.10 Layout and fabricate SCL interface 10/1/02 11/25/02 \$3.644 \$7.555

10/1/02 11/25/02 \$3.644 \$0 Layout and fabricate SCL interface \$7.555 \$11.199 Ovt. Work Act. Work ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Baseline Work Rem. Work ElecTechU 50% \$0 \$0 \$0 \$0 160 h 0 h 0 h 0 h 160 h \$0 15 MandS 11,199.2 \$11,199 \$0 \$11,199 11,199.2 0 0 11,199.2

Notes

WBS Definition-

Layout and fabrication of SCL interface cards.

M&S BOE-

\$3644 for components and fab costs (see cost book for details)

160 h Saclay technician at \$1888.80/w = \$7,555.20

total = \$11,199.20

Labor BOE-

A similar amount of effort is assumed for this task as for the analog splitter. The small increase in board complexity is not expected to significantly increase fabrication/assembly turnaround time.

WBS		Name					Start	t	Finish	M&S EQ	M&S La	bor Fl	NAL Labor	Total Cost
1.2.1.1.11		Bench test SC	L interface	9			11/26/02	2	1/3/03	\$0	\$3,	778	\$0	\$3,778
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	8	ElecTechU	50%	\$0	\$0	\$0	\$0	80 h	0 h	0 h	0 h	80	h	
	15	MandS	3,777.6	\$3,778	\$0	\$0	\$3,778	3,777.6		0	0	3,777.	6	

Notes

WBS Definition-

Test of SCL interface cards to verify basic functionality. Tests include the validation of the bi-directional link between the board and each ADF crate, and the correct distribution of timing and control signals via the SCL when the board is in-situ. Test with SCL signals is part of Prototype integration task.

M&S BOE-

80 h Saclay technician at \$1888.80/w = \$3,777.60

Labor BOE-

Estimate of lead engineer based on his experience with similar, simple boards.

1.2.1.1.12		Develop in-situ	exercizing/	debuggin	g software		5/5/03	9/24	-/03	\$0	\$41,235		\$0	\$41,235
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	4	ElecEngU	50%	\$0	\$0	\$0	\$0	400 h	0 h	0 h	0 h	400 h		
	10	PhysicistU	50%	\$0	\$0	\$0	\$0	400 h	0 h	0 h	0 h	400 h		
	15	MandS	41,234.93	\$41,235	\$0	\$0	\$41,235	41,234.93		0	0	41,234.93		

Notes

WBS Definition-

Develop special in situ and diagnostic software that cycles the system at design speed and verifies that the hardware gets the right answer. This software is used to download FPGA configuration, load programmable parameters, read-back captured data (e.g. input and output of the digital filter), and perform various tests (e.g. feed output link with a pseudo-random pattern to verify output link independently of digital filter).

M&S BOE -

400 hours of engineering at \$4123.49/w = \$41234.93

Labor BOE-

Experience with similar software from existing L1cal

1.2.1.1.13		ADF Prototype	e in-situ tes	ts			5/19/03	9	/10/03	\$0	\$9,89	96	\$0	\$9,896
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
•	4	ElecEngU	15%	\$0	\$0	\$0	\$0	96 h	0 h	0 h	0 h	96 h		
	10	PhysicistU	100%	\$0	\$0	\$0	\$0	640 h	0 h	0 h	0 h	640 h		
	15	MandS	9,896.38	\$9,896	\$0	\$0	\$9,896	9,896.38		0	0	9,896.38		

Notes

WBS Definition-

Perform parasitic tests with split-off signals from the run2a calorimeter trigger. Test perfomance of digital filter on different trigger towers in the calorimeter. Tests include the recording of pulse shapes on several channels, the validation of the digital filter algorithm with real input signals, the cross-check with calorimeter precision data recorded by D0 DAQ.

M&S BOE -

96 h of MSU engineering at \$4123.49/w = \$9,896.38

Labor BOE -

Estimate based on experience of lead engineer with digital filters and on experience understanding Run IIa L1Cal signals.

1.2.1.1.14		Final ADF des	ign				8/27/03		11/5/03	\$0	\$41,	236	\$0	\$41,236
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	4	ElecEngU	100%	\$0	\$0	\$0	\$0	400 h	0 h	0 h	0 h	400 h		
	15	MandS	41,236	\$41,236	\$0	\$0	\$41,236	41,236		0	0	41,236		

Notes

WBS Definition-

Update prototype design to address any shortcomings found in testing

M&S BOE-

400 hours of engineering at \$4122.95/w = \$41,229.48

Labor BOE-

/BS		Name					Start	Finish	,	M&S EQ	M&S Labor	FNAL La	ahor	Total Cost
nal ADF	desim	n" continued					Start	FIIIISII		WICKS EQ	IVICES LADUI	FINAL L	abui	TOTAL COST
iliai ADI	Notes													
		he time foreseen for	r the design of t	he board; o	nly small fixes exp	ected to be d	one.							
2.1.1.15		Procure ADF	components				11/6/03	1/28/04		\$114,523	\$4,124		\$0	\$118,647
.2.1.1.10	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost		· Ovt. Work	Baseline Work	Act. Work	Rem. Work	ΨΟ	Ψ110,047
	4	ElecEngU	10%	\$0	\$0	\$0	\$0	40 h	0 h	n 0 h	0 h	40 h		
	15	MandS	118,646.8	\$118,647	\$0	\$0	\$118,647	118,646.8		C	0	118,646.8	ľ	
		Definition- e all components for	r production ver	sion of ADF	(ADC's, FPGA's,	etc.)								
		OE - 23.20 in equipment university engineer												
	total = 1	- \$118,646.69												
		. ,												
	Labor E Averag	BOE- e amount of time ne	eeded for procui	rement at Fo	ermilab, based on	experience o	f M. Johnson.							
.2.1.1.16		Fabricate, Ass	•		•	•	1/29/04	3/24/04	<u> </u>	\$5,204	\$7,555		\$0	\$12,759
.2.1.1.10	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost		Work	Baseline Work	. ,	Rem. Work	ΨΟ	Ψ12,700
	8	ElecTechU	50%	\$0	\$0	\$0	\$0	160 h	0 h	0 h	0 h	160 h		
	15	MandS	12,759.2	\$12,759	\$0	\$0	\$12,759	12,759.2		0	0	12,759.2		
	Notes WBS D	efinition-												
		duction run												
		OE - nent \$5204 plus urs of university tecl	hnician time to f	follow the pr	oduction at \$1888	.80/w = \$755	5.20							
	equipm 160 ho	ent \$5204 plus	hnician time to f	follow the pr	oduction at \$1888	.80/w = \$755	5.20							
.2.1.1.17	equipm 160 ho total =	nent \$5204 plus urs of university tecl		ollow the pr	oduction at \$1888	.80/w = \$755	3/25/04	5/19/04	ļ	\$0	\$18,409		\$0	\$18,409
.2.1.1.17	equipm 160 ho total =	nent \$5204 plus urs of university tecl \$12,759.20		follow the pr	oduction at \$1888 Baseline Cost	.80/w = \$755 Act. Cost			 - vt. Work	\$0 Baseline Work	\$18,409 Act. Work	Rem. Work	\$0	\$18,409
.2.1.1.17	equipm 160 ho total =	nent \$5204 plus urs of university tecl \$12,759.20 Bench test 10 Resource Name ElecEngU	% ADF Units 10%	Cost \$0	Baseline Cost \$0	Act. Cost	3/25/04 Rem. Cost \$0	Work O	vt. Work 0 h	Baseline Work 0 h	Act. Work	32 h	\$ 0	\$18,409
.2.1.1.17	equipm 160 ho total = 1	ent \$5204 plus urs of university tecl \$12,759.20 Bench test 10 Resource Name ElecEngU ElecTechU PhysicistU	9% ADF Units 10% 100% 30%	Cost \$0 \$0 \$0 \$0	Baseline Cost \$0 \$0 \$0	Act. Cost \$0 \$0 \$0 \$0	3/25/04 Rem. Cost \$0 \$0 \$0	Work O 32 h 320 h 96 h	vt. Work	Baseline Work 0 h 0 h 0 h	Act. Work 0 h 0 h 0 h	32 h 320 h 96 h	\$0 _	\$18,409
.2.1.1.17	equipm 160 ho total = 1 1D 4 8 10 15	ent \$5204 plus urs of university teci \$12,759.20 Bench test 10 Resource Name ElecEngU ElecTechU	% ADF Units 10% 100%	Cost \$0 \$0	Baseline Cost \$0 \$0	Act. Cost \$0 \$0	3/25/04 Rem. Cost \$0 \$0	Work O 32 h 320 h	0 h 0 h	Baseline Work 0 h 0 h	Act. Work 0 h 0 h	32 h 320 h	\$0 _	\$18,409
.2.1.1.17	equipm 160 ho total = 1 10 4 8 10 15 Notes	ent \$5204 plus urs of university tecl \$12,759.20 Bench test 10 Resource Name ElecEngU ElecTechU PhysicistU	9% ADF Units 10% 100% 30%	Cost \$0 \$0 \$0 \$0	Baseline Cost \$0 \$0 \$0	Act. Cost \$0 \$0 \$0 \$0	3/25/04 Rem. Cost \$0 \$0 \$0	Work O 32 h 320 h 96 h	0 h 0 h	Baseline Work 0 h 0 h 0 h	Act. Work 0 h 0 h 0 h	32 h 320 h 96 h	\$ 0	\$18,409
.2.1.1.17	equipm 160 ho	Bench test 10 Resource Name ElecEngU ElecTechU PhysicistU MandS	10% Units 10% 100% 30% 18,409.28	Cost \$0 \$0 \$0 \$18,409	Baseline Cost \$0 \$0 \$0 \$0	Act. Cost \$0 \$0 \$0 \$0	3/25/04 Rem. Cost \$0 \$0 \$0 \$18,409	Work O 32 h 320 h 96 h 18,409.28	ovt. Work 0 h 0 h 0 h	Baseline Work 0 h 0 h 0 h 0 h	Act. Work 0 h 0 h 0 h	32 h 320 h 96 h	\$0 _	\$18,409
.2.1.1.17	equipm 160 ho 	Bench test 10 Resource Name ElecEngU ElecTechU PhysicistU MandS Definition- st 10% of boards be	10% Units 10% 100% 30% 18,409.28	Cost \$0 \$0 \$0 \$18,409	Baseline Cost \$0 \$0 \$0 \$0	Act. Cost \$0 \$0 \$0 \$0	3/25/04 Rem. Cost \$0 \$0 \$0 \$18,409	Work O 32 h 320 h 96 h 18,409.28	ovt. Work 0 h 0 h 0 h	Baseline Work 0 h 0 h 0 h 0 h	Act. Work 0 h 0 h 0 h	32 h 320 h 96 h	\$0 _	\$18,409
.2.1.1.17	equipm 160 ho total = ID 4 8 10 15 Wes E Test fir M&S B 320 h c	Bench test 10 Resource Name ElecEngU ElecTechU PhysicistU MandS Definition- st 10% of boards be	10% ADF Units 10% 100% 30% 18,409.28 Perfore approving tian time @ \$188	Cost \$0 \$0 \$0 \$0 \$18,409 full producti 88.80/w = \$	### Baseline Cost \$0 \$0 \$0 \$0 \$0 \$0 \$15,110.40 plus	Act. Cost \$0 \$0 \$0 \$0	3/25/04 Rem. Cost \$0 \$0 \$0 \$18,409	Work O 32 h 320 h 96 h 18,409.28	ovt. Work 0 h 0 h 0 h	Baseline Work 0 h 0 h 0 h 0 h	Act. Work 0 h 0 h 0 h	32 h 320 h 96 h	\$0 _	\$18,409
.2.1.1.17	equipm 160 ho total = ID 4 8 10 15 Notes WBS D Test fir M&S B 320 h c 32 h of	Bench test 10 Resource Name ElecEngU ElecTechU PhysicistU MandS Definition- st 10% of boards be OCE - of university technici	10% ADF Units 10% 100% 30% 18,409.28 Perfore approving tian time @ \$188	Cost \$0 \$0 \$0 \$0 \$18,409 full producti 88.80/w = \$	### Baseline Cost \$0 \$0 \$0 \$0 \$0 \$0 \$15,110.40 plus	Act. Cost \$0 \$0 \$0 \$0	3/25/04 Rem. Cost \$0 \$0 \$0 \$18,409	Work O 32 h 320 h 96 h 18,409.28	ovt. Work 0 h 0 h 0 h	Baseline Work 0 h 0 h 0 h 0 h	Act. Work 0 h 0 h 0 h	32 h 320 h 96 h	\$0 _	\$18,409
.2.1.1.17	equipm 160 ho total = ID	Bench test 10 Resource Name ElecEngU ElecTechU PhysicistU MandS Definition- st 10% of boards be output funiversity technici university engineer \$18,409.19	9% ADF Units 10% 100% 30% 18,409.28 efore approving tian time @ \$188 ting time @ \$411	Cost \$0 \$0 \$18,409 full producti 38.80/w = \$ 23.49/w = \$	Baseline Cost \$0 \$0 \$0 \$0 \$0 \$0 on run. Same test	Act. Cost \$0 \$0 \$0 \$0	3/25/04 Rem. Cost \$0 \$0 \$0 \$18,409	Work O 32 h 320 h 96 h 18,409.28	ovt. Work 0 h 0 h 0 h	Baseline Work 0 h 0 h 0 h 0 h	Act. Work 0 h 0 h 0 h	32 h 320 h 96 h	\$0	\$18,409
	equipm 160 ho total = ID	Bench test 10 Resource Name ElecEngU ElecTechU PhysicistU MandS Definition- st 10% of boards be of university technici university engineer \$18,409.19 BOE- effort required for p	1% ADF Units 10% 100% 30% 18,409.28 efore approving tian time @ \$188 ting time @ \$412	Cost \$0 \$0 \$18,409 full producti 38.80/w = \$ 23.49/w = \$	Baseline Cost \$0 \$0 \$0 \$0 \$0 \$0 on run. Same test	Act. Cost \$0 \$0 \$0 \$0	3/25/04 Rem. Cost \$0 \$0 \$0 \$18,409	Work 0 32 h 320 h 96 h 18,409.28	vt. Work 0 h 0 h 0 h	Baseline Work 0 h 0 h 0 h 0 s feeding a TAB.	Act. Work 0 h 0 h 0 h 0 o	32 h 320 h 96 h	_	
.2.1.1.17	equipm 160 ho total = ID	Bench test 10 Resource Name ElecEngU ElecTechU PhysicistU MandS Definition- st 10% of boards be OE - of university engineer \$18,409.19 30E- effort required for p	1% ADF Units 10% 30% 30% 18,409.28 efore approving ian time @ \$188 ing time @ \$412	Cost \$0 \$0 \$0 \$18,409 full producti 38.80/w = \$ 23.49/w = \$	Baseline Cost \$0 \$0 \$0 \$0 on run. Same test 15,110.40 plus 3298.79	Act. Cost \$0 \$0 \$0 \$0 \$0	3/25/04 Rem. Cost \$0 \$0 \$0 \$18,409	Work 0 32 h 320 h 320 h 18,409.28 sts with several A	ovt. Work O h O h O h	Baseline Work 0 h 0 h 0 h 0 s feeding a TAB.	Act. Work 0 h 0 h 0 h 0 h 84,911	32 h 320 h 96 h 18,409.28	\$0 	\$18,409 \$51,747
	equipm 160 ho total = ID	Bench test 10 Resource Name ElecEngU ElecTechU PhysicistU MandS Definition- st 10% of boards be of university technici university engineer \$18,409.19 BOE- effort required for p	1% ADF Units 10% 100% 30% 18,409.28 efore approving tian time @ \$188 ting time @ \$412	Cost \$0 \$0 \$18,409 full producti 38.80/w = \$ 23.49/w = \$	Baseline Cost \$0 \$0 \$0 \$0 \$0 \$0 on run. Same test	Act. Cost \$0 \$0 \$0 \$0	3/25/04 Rem. Cost \$0 \$0 \$0 \$18,409	Work 0 32 h 320 h 320 h 18,409.28 sts with several A	vt. Work 0 h 0 h 0 h	Baseline Work 0 h 0 h 0 h 0 s feeding a TAB.	Act. Work 0 h 0 h 0 h 0 o	32 h 320 h 96 h	_	

WBS M&S EQ **Total Cost** Name Start Finish M&S Labor **FNAL Labor** "Fabricate production ADF" continued WBS Definition-Fabricate remaining 90% of production ADF boards. M&S BOE -\$46,836 in equipment, plus 104 h of univeristy technician time to follow production @ \$1888.8/w = \$4910.88 total = \$51.746.88 1.2.1.1.19 Bench test production ADF 6/4/04 12/8/04 \$0 \$59,830 \$0 \$59,830 Resource Name Baseline Work Rem. Cost Work Ovt. Work Act. Work Rem. Work Cost Baseline Cost Act. Cost ElecEngU \$0 104 h 0 h 104 h 10% \$0 \$0 \$0 0 h 0 h 8 ElecTechU 100% \$0 \$0 \$0 \$0 1,040 h 0 h 0 h 0 h 1,040 h 10 PhysicistU 30% \$0 \$0 \$0 \$0 312 h 0 h 0 h 0 h 312 h 59,830.16 \$59.830 \$0 \$0 0 0 59.830.16 15 MandS \$59,830 59,830.16 Notes WBS Definition-Same tests as for 1.2.1.1.17, but for final production boards. M&S BOE -1040 h of univeristy technician time at \$1888.8/w = \$49108.80 plus 104 h of university engineer time at \$4123.49/w = \$10721.08 total = \$59,829.88 Labor BOE-Further streamlining of testing assumed. At this stage all flaws in the design should be ironed out. Testing should be mainly to catch fabrication faults. 1.2.1.1.20 \$0 \$0 \$0 \$0 L1 Calorimeter Trigger ADF Production Complete 12/8/04 12/8/04 Notes WBS Definitionmilestone: All ADF cards ready for installation and commissioning 1.2.1.1.21 11/25/02 7/9/04 \$0 \$32.989 \$0 \$32.989 Digital filter FPGA programming Act. Cost Baseline Work ID Resource Name Cost Baseline Cost Rem. Cost Work Ovt. Work Act. Work Rem. Work 4 ElecEnaU 10% \$0 \$0 \$0 \$0 320 h 0 h 0 h 0 h 320 h 10 \$0 \$0 \$0 0 h **PhysicistU** 30% \$0 960 h 0 h 0 h 960 h 15 MandS 32.988.8 \$32.989 \$0 \$0 \$32.989 32.988.8 0 0 32.988.8 Notes WBS Definition-Develop digital filter algorithms based on simulations and results of ADF prototype. 320 h of Saclay engineering time at \$4122.95/w = \$32,983.58 Based on actual time taken for the completion and implementation of the prototype algorithm (8-tap FIR + 3 point peak detector + final Et look-up table) 1.2.1.1.22 ADF offline software and analysis 3/24/03 10/22/03 \$0 \$0 \$0 \$0 Resource Name Baseline Cost Rem. Cost Work Ovt. Work Rem. Work Act. Cost Baseline Work Act. Work 10 PhysicistU \$0 \$0 \$0 600 h 0 h Write software for the offline analysis of the ADF data acquired in the in-situ test. These results are used to optimize the digital filter design. 50% of a physicists is needed for the duration of the task. Preparation must start 8 weeks before the in-situ test begin, and continue six weeks after the test are complete in order to analyze the data taken.

							IXUII IID	riiggei						
WBS		Name					Start		Finish	M&S EQ	M&S Labor	FNAL I	Labor	Total Cost
.2.1.2		ADF Crates efinition- 6u VME crates with	n a (probably)	custom J2	backplane		10/14/02	1	1/19/03	\$53,700	\$68,800		\$0	\$122,500
2121			,,				10/14/02	1	1/22/02	\$ 0	\$24,742		\$0	¢24.742
1.2.1.2.1	ID 4	Design transit Resource Name ElecEngU	Units 100%	one Cost \$0	Baseline Cost		10/14/02 Rem. Cost \$0	Work 240	Ovt. Work	\$0 ** Baseline Work **D h 0	Act. Work	Rem. Work 240 h	\$ 0 -	\$24,742
	Design	onnectors on the BL	24,741.6 for ADF crate: S cable side,	\$24,742 s. This eler and 20 96 o	\$6 ment is used to br or 160-point conn	ing 640 differ	ential analog sig	24,741. nals to the side. Trivi	20 ADF board	ds that are housed in electronics point c	0 0 n each ADF crate. f view; minor mecl	24,741.6 The passive nanical issues	custom bac ; controlled	skplane comprises impedance lines r
	M&S Book 240 h c	OE- f Saclay engineerir	-											
.2.1.2.2		Layout and fa	bricate tran	sition bad	ckplane		12/2/02		2/5/03	\$0	\$7,555		\$0	\$7,555
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work		m. Work		
	8 15	ElecTechU MandS	50% 7,555.2	\$0 \$7,555	\$0 \$0	\$0 \$0	\$0 \$7,555	160 h 7,555.2	0 h	0 h 0	0 h 0	160 h 7,555.2		
	M&S B \$0 for c 160 h S total = S	omponents and fab saclay technician at \$7,555.20 BOE- e from lead engine	o costs (reuse \$1888.80/w =	material at \$7,555.20 omplexity o	f design.									
.2.1.2.3	ID	Fabricate/Ass		• •		4-4-04	2/6/03 Rem. Cost	Work	4/2/03 Ovt. Work	\$0 Baseline Work	\$7,555	m. Work	\$0	\$7,555
	8 15 Notes WBS D	ElecTechU MandS	Units 50% 7,555.2	\$0 \$7,555	\$0 \$0 \$0	### Act. Cost \$0 \$0	\$0 \$7,555	160 h 7,555.2	0 h	0 h	Act. Work Re. 0 h 0	160 h 7,555.2		
	M&S Book	OE- components and fat saclay technician at \$7,555.20	o costs (reuse \$1888.80/w =	material at : \$7,555.20	,	STT system (-	~1 month).							
.2.1.2.4		Test prototype	e crate ADF	in protot	ype crate		4/3/03		5/29/03	\$0	\$9,620		\$0	\$9,620
	ID 4	Resource Name ElecEngU	Units 20%	Cost	Baseline Cost \$0	Act. Cost	Rem. Cost	Work 64 h	Ovt. Work	Baseline Work	Act. Work	Rem. Work 64 h	•	. , -
	8 10	ElecTrigo ElecTechU PhysicistU	20% 30%	\$0 \$0 \$0	\$0 \$0	\$0 \$0	\$0 \$0 \$0	64 h 96 h	01	h 0 h	0 h	64 h 96 h		

Tact arati		Name					Start	Fin	ish	M&S EQ	M&S Labor	FNAL L	abor	Total Cost
est prott	otype cr	rate ADF in proto	type crate'	' continue	ed									
	ID 15	Resource Name MandS	Units 9,619.84	Cost	Baseline Cost	Act. Cost	Rem. Cost		vt. Work	Baseline Work 0	Act. Work 1	Rem. Work		
			9,019.04	\$9,620	\$0	\$0	\$9,620	9,619.84		U	Ü	9,619.84		
	WRS D	efinition-												
		ototype ADF cards in	prototype cra	ate. Feed A	DF prototyte boa	ard with analog	g signals via pro	otype backplan	e. Measure	e signal degradatio	n (expected to b	e negligible).		
		OE- aclay engineer at \$41 aclay technician at \$1			s									
	total = \$	\$9,618.80												
	Labor B Estimat	BOE- te from lead engineer	. Testing tim	e comparat	ole to that of testi	ng analog spli	tter cards.							
2.1.2.5	Notes	L1 Calorimete	r Trigger A	ADF+Cra	te Prototype	Comt	5/29/03	5/29	03	\$0	\$0		\$0	\$0
		efinition-												
2.1.2.6		Final backplane	e design				9/11/03	10/8	03	\$0	\$16,494		\$0	\$16,494
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost		Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	4 15	ElecEngU MandS	100% 16,494.4	\$0 \$16,494	\$0 \$0	\$0 \$0	\$0 \$16,494	160 h 16,494.4	0 h	0 h 0	0 h 0	160 h 16,494.4		
			. 0, . 0	0.0,.0.	40		\$10,101	76,767.7		· ·	·	70, 70 1. 1		
	Notes WRS D	efinition-												
		prototype design to	address any s	shortcoming	s found in testing	j .								
	M&S B0 160 hou	OE- urs of engineering at	\$4122.95/w =	= \$16,491.7	9									
	Labor B Estimat	BOE- te from lead engineer	. Taken to be	same as ti	me for initial desi	gn (1.2.1.2.1).								
.2.1.2.7		te from lead engineer			me for initial desi	gn (1.2.1.2.1).	10/9/03	11/12	/03	\$50,200	\$944		\$0	\$51,144
2.1.2.7					me for initial desi	gn (1.2.1.2.1). Act. Cost		11/12. Work	'03 Ovt. Work	\$50,200 Baseline Work	\$944 Act. Work	Rem. Work	\$0	\$51,144
2.1.2.7	Estimat	Procure crate of Resource Name	components Units	S Cost	Baseline Cost	Act. Cost	10/9/03 Rem. Cost	Work 20 h		Baseline Work	Act. Work	20 h	\$ 0	\$51,144
2.1.2.7	Estimat	Procure crate of Resource Name ElecTechU MandS	omponents	S Cost	Baseline Cost	Act. Cost	10/9/03 Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work		\$0 _	\$51,144
.2.1.2.7	Estimat ID 8 15 Notes	Procure crate of Resource Name ElecTechU MandS	components Units	S Cost	Baseline Cost	Act. Cost	10/9/03 Rem. Cost	Work 20 h	Ovt. Work	Baseline Work	Act. Work	20 h	\$ 0	\$51,144
.2.1.2.7	Estimat ID 8 15 Notes WBS D	Procure crate of Resource Name ElecTechU MandS	omponents <i>Units</i> 10% 51,144.44	S Cost \$0 \$51,144	Baseline Cost \$0 \$0	Act. Cost	10/9/03 Rem. Cost	Work 20 h	Ovt. Work	Baseline Work	Act. Work	20 h	\$0 _	\$51,144
.2.1.2.7	ID 8 15 Notes WBS D Procure M&S BG Equipm	Procure crate of Resource Name ElecTechU MandS effinition- backplanes, power OE - lent at \$50,200.	Units 10% 51,144.44 supplies, and	S Cost \$0 \$51,144	Baseline Cost \$0 \$0 al parts.	Act. Cost 0 \$0 0 \$0	10/9/03 Rem. Cost \$0 \$51,144	Work 20 h	Ovt. Work	Baseline Work	Act. Work	20 h	\$0	\$51,144
.2.1.2.7	ID 8 15 Notes WBS D Procure M&S BG Equipm 20 hour	te from lead engineer Procure crate of Resource Name ElecTechU MandS refinition- e backplanes, power OE -	Units 10% 51,144.44 supplies, and	S Cost \$0 \$51,144	Baseline Cost \$0 \$0 al parts.	Act. Cost 0 \$0 0 \$0	10/9/03 Rem. Cost \$0 \$51,144	Work 20 h	Ovt. Work	Baseline Work	Act. Work	20 h	\$0 _	\$51,144
2.1.2.7	ID 8 15 Notes WBS D Procure M&S B6 Equipm 20 hour total = \$ Labor B	Procure crate of Resource Name ElecTechU MandS refinition- backplanes, power DOE - nent at \$50,200. rs of university electri	Units 10% 51,144.44 supplies, and	S Cost \$0 \$51,144	Baseline Cost \$0 \$0 al parts.	Act. Cost 0 \$0 0 \$0	10/9/03 Rem. Cost \$0 \$51,144	Work 20 h	Ovt. Work	Baseline Work	Act. Work	20 h	\$0	\$51,144
	ID 8 15 Notes WBS D Procure M&S B6 Equipm 20 hour total = \$ Labor B	Procure crate of Resource Name ElecTechU MandS efinition- e backplanes, power one of university electric structures of university electric st	Units 10% 51,144.44 supplies, and	S Cost \$0 \$51,144	Baseline Cost \$0 \$0 al parts.	Act. Cost 0 \$0 0 \$0	10/9/03 Rem. Cost \$0 \$51,144	Work 20 h	Ovt. Work	Baseline Work	Act. Work	20 h	\$0 	\$51,144
.2.1.2.7	ID 8 15 Notes WBS D Procure M&S B6 Equipm 20 hour total = \$ Labor B	te from lead engineer Procure crate of Resource Name ElecTechU MandS lefinition- e backplanes, power one at \$50,200. rs of university electri \$51,144.40 BOE- te from lead engineer	Units 10% 51,144.44 supplies, and	S Cost \$0 \$51,144 mechanica to research	Baseline Cost \$0 \$0 al parts.	Act. Cost 0 \$0 0 \$0	10/9/03 Rem. Cost S0 \$51,144	Work 20 h 51,144.44	Ovt. Work	Baseline Work h 0	Act. Work h 0 0 0 0 \$1,889	20 h	_	
	ID 8 15 Notes WBS D Procure M&S B6 Equipm 20 hour total = \$ Labor B Estimat	Procure crate of Resource Name ElecTechU MandS refinition- be backplanes, power of the procure	units 10% 51,144.44 supplies, and cal technican crates Units 100%	S Cost \$0 \$51,144 mechanica to research	Baseline Cost Storm and place order Baseline Cost \$0	Act. Cost Act. Cost So	10/9/03 Rem. Cost 0 \$0 \$51,144 0/w =\$944.40 11/13/03 Rem. Cost \$0	Work 51,144.44 11/19. Work Ovt. 40 h	Ovt. Work	\$3,500 Saseline Work O h	Act. Work h 0 h 0 \$1,889 Act. Work Re 0 h	20 h 51,144.44 m. Work 40 h	_	
	ID 8 15 Notes WBS D Procure M&S BC Equipm 20 hour total = \$ Labor B Estimat	Procure crate of Resource Name ElecTechU Mands elefinition- e backplanes, power one at \$50,200. The soft university electric \$51,144.40 BOE- te from lead engineer Assemble ADF Resource Name	Units 10% 51,144.44 supplies, and cal technican crates Units	S Cost \$0 \$51,144 mechanica	Baseline Cost \$0 \$0 \$1 parts. In and place order Baseline Cost	Act. Cost Act. Cost Act. Cost	10/9/03 Rem. Cost So \$51,144 0/w =\$944.40 11/13/03 Rem. Cost	Work 20 h 51,144.44 11/19 Work Ovt.	Ovt. Work 0 703 Work E	\$3,500 Baseline Work	Act. Work h 0 0 0 \$1,889	20 h 51,144.44	_	
	ID 8 15 Notes WBS Di Procure W&S BC Equipm 20 hour total = \$ Labor B Estimat ID 8 15 Notes Notes	te from lead engineer Procure crate of Resource Name ElecTechU MandS definition- e backplanes, power OE - nent at \$50,200. rs of university electri \$51,144.40 BOE- te from lead engineer ASSemble ADF Resource Name ElecTechU MandS	units 10% 51,144.44 supplies, and cal technican crates Units 100%	S Cost \$0 \$51,144 mechanica to research	Baseline Cost Storm and place order Baseline Cost \$0	Act. Cost Act. Cost So	10/9/03 Rem. Cost 0 \$0 \$51,144 0/w =\$944.40 11/13/03 Rem. Cost \$0	Work 51,144.44 11/19. Work Ovt. 40 h	Ovt. Work 0 703 Work E	\$3,500 Saseline Work O h	Act. Work h 0 h 0 \$1,889 Act. Work Re 0 h	20 h 51,144.44 m. Work 40 h	_	

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Assembl		Name					Start		Finish	M&S EQ	M&S Labo	or FNA	L Labor	Total Cost
toociiibi		crates" continue	d											
	Notes			-										
	M&S B													
		ane fabrication & as h of university elec			= \$1888.80									
	total =	\$5,388.80												
	Labor E Similar	BOE- to 1.2.1.2.3.												
.2.1.3		Trigger Algor	rithm Boar	rd			2/1/02	1	0/18/04	\$109,038	\$155,73	2	\$0	\$264,770
	Notes			_										
		Definition- Immary element cov	ers the algor	ithm board	which receives th	e filtered towe	er transverse ene	ergies from	the ADF boar	ds and finds jet, EN	ℳ and tau cluster	S.		
	Risk M	itigation (cost)-												
	Risk of	escalation in parts	cost due to ui	nforeseen o	design changes is	mitigated by	the relatively larg	ge continge	ncy assigned	to the procurement	t of components	and fabrication	n/assembly g	iven the advanced s
	Extra N	sign (prototype iayot Jevis personnel can	it started). C be diverted to	ost risk fror o the projec	n extra labor need of should the need	ded to comple I arise.	te the project is	reaucea be	cause of the la	arge traction of the	labor that is cov	erea by in-kin	a contribution	s from Columbia/Ne
2.1.3.1		Choose L1 C	alorimeter	r Trigger	Baseline Jet	Algori	8/8/02		8/8/02	\$0	\$	0	\$0	\$0
	Notes			-		_								
		efinition- ne: Establish baseli	ne jet cluster	algorithm t	hat will be used to	specify the p	orototype TAB.							
2.1.3.2		Design prototy	ype Trigge	r Algorith	m Board (TAE	3)	2/1/02		10/1/02	\$0	\$93,11	0	\$0	\$93,110
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work	_	
	4	ElecEngU	74%	\$0	\$0	\$0	\$0	999.6 h	0 h	0 h	799.68 h	199.92 h		
	15	MandS	93,110	\$93,110	\$0	\$93,110	\$0	93,110		0	74,488	18,622		
	15 Notes		93,110	\$93,110										
	Notes WBS D	Definition-		-	\$0	\$93,110	\$0							
	Notes WBS D			-	\$0	\$93,110	\$0							
	Notes WBS D Design M&S B	Definition- a full prototype trigg	ger algorithm	board with	\$0 all input, output a	\$93,110	\$0							
	Notes WBS D Design M&S B 1000 h	Definition- a full prototype trigg OE- of Columbia engine	ger algorithm	board with	\$0 all input, output a	\$93,110	\$0							
	Notes WBS D Design M&S B 1000 h	Definition- a full prototype trigg OE- of Columbia engine	ger algorithm eering at \$372	board with	\$0 all input, output a	\$93,110	\$0							
2422	Notes WBS D Design M&S B 1000 h	Definition- a full prototype trigg OE- of Columbia engine BOE- ted from progress s	ger algorithm eering at \$372 o far.	board with	\$0 all input, output a	\$93,110	\$0		10/4/02	0	74,488	18,622	¢0	PD 522
2.1.3.3	Motes WBS D Design M&S B 1000 h Labor E Estima	Definition- a full prototype trigg OE- of Columbia engine BOE- ted from progress so Layout prototy	ger algorithm eering at \$372 o far. /pe TAB	board with	\$0 all input, output a 93,110.00	\$93,110	\$0 nnections. 8/9/02	93,110	10/4/02	\$0	74,488 \$8,53	18,622	\$0	\$8,533
2.1.3.3	Motes WBS D Design M&S B 1000 h Labor E Estima	Definition- a full prototype trigg OE- of Columbia engine BOE- ted from progress so Layout prototy Resource Name ElecEngU	ger algorithm eering at \$372 o far. //pe TAB Units 29%	board with 24.40/w = \$	all input, output a 93,110.00 Baseline Cost	\$93,110 Ind control cool Act. Cost \$0	\$0 nnections. 8/9/02 Rem. Cost \$0	93,110 Work 92 h	10/4/02 Ovt. Work 0 h	0	74,488 \$8,53 Act. Work 46 h	18,622 13 Rem. Work 46 h	\$0	\$8,533
2.1.3.3	Notes WBS D Design M&S B 1000 h Labor E Estima	Definition- a full prototype trigg OE- of Columbia engine BOE- ted from progress so Layout prototy Resource Name	ger algorithm eering at \$372 o far. //pe TAB Units	board with 24.40/w = \$	\$0 all input, output a 93,110.00 Baseline Cost	\$93,110 Ind control c	\$0 nnections. 8/9/02 Rem. Cost	93,110 Work	Ovt. Work	\$0 Baseline Work	74,488 \$8,53 Act. Work	18,622	\$0	\$8,533
2.1.3.3	Notes WBS D Design M&S B 1000 h Labor E Estima	Definition- a full prototype trigg OE- of Columbia engine BOE- ted from progress so Layout prototy Resource Name ElecEngU MandS	ger algorithm eering at \$372 o far. //pe TAB Units 29%	board with 24.40/w = \$	all input, output a 93,110.00 Baseline Cost	\$93,110 Ind control cool Act. Cost \$0	\$0 nnections. 8/9/02 Rem. Cost \$0	93,110 Work 92 h	Ovt. Work	\$0 Baseline Work 0 h	74,488 \$8,53 Act. Work 46 h	18,622 13 Rem. Work 46 h	\$0	\$8,533
2.1.3.3	Motes WBS D Design M&S B 1000 h Labor E Estima ID 4 15 Notes WBS D	Definition- a full prototype trigg OE- of Columbia engine BOE- ted from progress so Layout prototy Resource Name ElecEngU MandS	ger algorithm eering at \$372 o far. //pe TAB //pe TAB //pe TAB //pe S9% 8,532.8	- board with 24.40/w = \$	all input, output a 93,110.00 Baseline Cost \$0 \$0	\$93,110 Ind control c	\$0 nnections. 8/9/02 Rem. Cost \$0 \$0	93,110 Work 92 h 8,532.8	Ovt. Work	\$0 Baseline Work 0 h	74,488 \$8,53 Act. Work 46 h	18,622 13 Rem. Work 46 h	\$0	\$8,533
2.1.3.3	Notes WBS D Design M&S B 1000 h Labor E Estima ID 4 15 Notes WBS D Layout M&S B	Definition- a full prototype trigg OE- of Columbia engine BOE- ted from progress so Layout prototy Resource Name ElecEngU MandS Definition- of prototype TAB pro	ger algorithm sering at \$372 o far. //PE TAB Units 29% 8,532.8	- board with 24.40/w = \$ - Cost	all input, output a 93,110.00 Baseline Cost \$0 \$0 lesign because of	\$93,110 Ind control c	\$0 nnections. 8/9/02 Rem. Cost \$0 \$0	93,110 Work 92 h 8,532.8	Ovt. Work	\$0 Baseline Work 0 h	74,488 \$8,53 Act. Work 46 h	18,622 13 Rem. Work 46 h	\$0	\$8,533
2.1.3.3	Notes WBS D Design M&S B 1000 h Labor E Estima ID 4 15 Notes WBS D Layout M&S B	Definition- a full prototype trigg OE- of Columbia engine BOE- ted from progress so Layout prototy Resource Name ElecEngU MandS Definition- of prototype TAB pr	ger algorithm sering at \$372 o far. //PE TAB Units 29% 8,532.8	- board with 24.40/w = \$ - Cost	all input, output a 93,110.00 Baseline Cost \$0 \$0 lesign because of	\$93,110 Ind control c	\$0 nnections. 8/9/02 Rem. Cost \$0 \$0	93,110 Work 92 h 8,532.8	Ovt. Work	\$0 Baseline Work 0 h	74,488 \$8,53 Act. Work 46 h	18,622 13 Rem. Work 46 h	\$0	\$8,533
2.1.3.3	M&S B 1000 h Labor E Estima ID 4 15 Notes WBS C Layout M&S B 92 hou Labor E Labor E	Definition- a full prototype trigg OE- of Columbia engine BOE- ted from progress so Layout prototy Resource Name ElecEngU MandS Definition- of prototype TAB process OE - rs of Columbia engine	ger algorithm eering at \$372 o far. //pe TAB Units 29% 8,532.8 roceeds in pa	- board with 24.40/w = \$ - cost \$0 \$8,533 - corallel with of	all input, output a 93,110.00 Baseline Cost \$0 \$0 lesign because of \$8,566.12	\$93,110 Ind control con Act. Cost \$0 \$8,533	8/9/02 Rem. Cost \$0 \$0 r of signals to be	93,110 Work 92 h 8,532.8 routed.	Ovt. Work 0 h	\$0 Baseline Work 0 h 0	\$8,53 Act. Work 46 h 4,266.4	18,622 33 Rem. Work 46 h 4,266.4	\$0	\$8,533
	M&S B 1000 h Labor E Estima ID 4 15 Notes WBS C Layout M&S B 92 hou Labor E Labor E	Definition- a full prototype trigg OE- of Columbia engine BOE- ted from progress s Layout prototy Resource Name ElecEngU MandS Definition- of prototype TAB process of Columbia engine BOE- on layout time for R	ger algorithm eering at \$372 o far. //PE TAB Units 29% 8,532.8 roceeds in pa neering at \$3	Cost \$0 \$8,533 - corallel with corallel with corallel Track Trigg	all input, output a 93,110.00 Baseline Cost \$0 \$0 lesign because of \$8,566.12	\$93,110 Ind control con Act. Cost \$0 \$8,533	8/9/02 Rem. Cost \$0 \$0 r of signals to be	93,110 Work 92 h 8,532.8 routed.	Ovt. Work 0 h	\$0 Baseline Work 0 h 0	\$8,53 Act. Work 46 h 4,266.4	18,622 13 Rem. Work 46 h 4,266.4		
2.1.3.3	M&S B 1000 h Labor E Estima ID 4 15 Notes WBS C Layout M&S B 92 hou Labor E Labor E	Definition- a full prototype trigg OE- of Columbia engine BOE- ted from progress si Layout prototy Resource Name ElecEngU MandS Definition- of prototype TAB pi OE - rs of Columbia engine	ger algorithm eering at \$372 o far. //PE TAB Units 29% 8,532.8 roceeds in pa neering at \$3	Cost \$0 \$8,533 - corallel with corallel with corallel Track Trigg	all input, output a 93,110.00 Baseline Cost \$0 \$0 lesign because of \$8,566.12	\$93,110 Ind control con Act. Cost \$0 \$8,533	8/9/02 Rem. Cost \$0 \$0 r of signals to be	93,110 Work 92 h 8,532.8 routed.	Ovt. Work 0 h	\$0 Baseline Work 0 h 0	\$8,53 Act. Work 46 h 4,266.4 ased board comp	18,622 13 Rem. Work 46 h 4,266.4	\$0	\$8,533 \$17,931

WBS Name Start Finish M&S EQ M&S Labor FNAL Labor Total Cost

"Procure prototype TAB parts" continued

Notes

WBS Definition-

Procure all parts for prototype of TAB cards.

M&S BOE-

\$15798 for equipment.

Details of the components going into this cost estimate are available in the supporting material folder.

plus 40 hours of university technican to carry out procurement at \$2133.33/w = \$2133.33

total = \$17,931.33

Labor BOE-

Average amount of effort needed for procurement at Fermilab, based on experience of M. Johnson. Time required based on experience with long lead-time electronics purchases.

1.2.1.3.5 Fabricate/Assemble Prototype TAB 11/4/02 1/9/03 \$10.000 \$1.707 \$0

	Fabricate/Asser	lible Prototi	ype rab			11/4/02	1/9	/03	\$10,000	\$1,707		ΦU
ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work	
8	ElecTechU	10%	\$0	\$0	\$0	\$0	32 h	0 h	0 h	0 h	32 h	
15	MandS	11,706.56	\$11,707	\$0	\$0	\$11,707	11,706.56		0	0	11,706.56	

\$11,707

Notes

WBS Definition-

Fabricate two prototype cards.

M&S BOE -

10,000 for fabrificaion and assembly, plus

32 hours of university technician at \$2133.33/w = \$1,706.66

total = \$11706.66

Labor BOE-

Based on Fab/Assembly time for STT FRC - 4 weeks. Multiplied by a factor of 2 to account for increased board complexity.

1.2.1.3.6		Develop TAB/	GAB tes	t softwa	ire		11/4	1/02	11/19/03	3	\$0	\$0	\$0	\$0
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	13	StudentU	10%	\$0	\$0	\$0	\$0	208 h	0 h	0 h	0 h	208 h	-	
	14	PostdocU	10%	\$0	\$0	\$0	\$0	208 h	0 h	0 h	0 h	208 h		

Notes

WBS Definition-

Write software necessary for testing the prototype and production TAB and GAB cards.

M&S BOE-

n/a

Labor BOE-

Based on the amount of effort required to write similar software for the STT FRCs, cards which have a similar number of functions to be tested.

1.2.1.3.7		Test prototype	TAB				1/10/03	5/16	5/03	\$0	\$15,328		\$0	\$15,328
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	4	ElecEngU	20%	\$0	\$0	\$0	\$0	144 h	0 h	0 h	0 h	144 h		
	8	ElecTechU	5%	\$0	\$0	\$0	\$0	36 h	0 h	0 h	0 h	36 h		
	10	PhysicistU	20%	\$0	\$0	\$0	\$0	144 h	0 h	0 h	0 h	144 h		
	13	StudentU	50%	\$0	\$0	\$0	\$0	360 h	0 h	0 h	0 h	360 h		
	15	MandS	15 327 72	\$15,328	\$0	\$0	\$15,328	15 327 72		0	0	15 327 72		

Notes

WBS Definition-

Test in test stand to verify that simulated inputs produce correct outputs for all of TAB functions: EM, jet, tau cluster finding, partial global sums, Cal-Trk match output, L2/L3 output.

M&S BOE -

144 hours of Columbia engineer at \$3724.40/w = \$13407.84 plus

36 hours of Columbia technician at \$2133.33/w = \$1920.00

WBS Start Finish M&S EQ M&S Labor **FNAL Labor Total Cost** Name "Test prototype TAB" continued total = \$15,327.84 Labor BOE-Based on the amount of effort required to test the STT FRC and BC cards before they could be submitted for production. The complexity of the TAB is similar to that of the FRC and BC taken together. 1.2.1.3.8 L1 Calorimeter Trigger TAB Prototype Complete 5/16/03 5/16/03 \$0 \$0 \$0 \$0 WBS Definition-Milestone: TAB prototype complete and passes bench tests: produces all the correct outputs for known inputs or failures understood. 1.2.1.3.9 Pre-production TAB design 10/10/03 11/6/03 \$0 \$2,980 \$0 \$2,980 Resource Name Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Cost ElecEnaU 20% \$0 \$0 \$0 \$0 32 h 0 h 0 h 0 h 32 h 15 2.979.62 \$2.980 \$0 MandS \$0 \$2.980 2.979.62 0 2.979.62 Notes WBS Definition-Update prototype design to address any shortcomings found in testing. This process will occur largely in parallel with the TAB prototype testing. 32 hours of Columbia engineer at \$3274.40/w = \$2,979.52 Estimated from time required to implement final changes to FRC design after testing. 1.2.1.3.10 11/7/03 1/29/04 \$58,240 \$2,133 \$0 \$60,373 Procure TAB parts Resource Name Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Rem. Work Cost Act. Work ElecTechU 10% \$0 \$0 \$0 \$0 40 h 0 h 0 h 0 h 40 h 15 60,373.2 \$60.373 \$0 60,373.2 MandS \$0 \$60,373 0 0 60,373.2 Notes WBS Definition-Procure all parts for production of TAB cards. M&S BOE-Details of the components going into this cost estimate are available in the supporting material folder. Equipment = \$58,240, plus 40 hours of electrical technician at \$2133.33/w = \$2133.33 total = \$60.373.33 Labor BOE-Average amount of effort needed for procurement at Fermilab, based on experience of M. Johnson. Time required based on experience with long lead-time electronics purchases. 1.2.1.3.11 Layout pre-production TAB 11/7/03 12/22/03 \$0 \$11.173 \$0 \$11.173 ID Resource Name Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work ElecEngU 50% \$0 \$0 \$0 120 h 0 h 0 h 120 h 0 h 15 MandS 11,173.2 \$11,173 \$0 \$0 \$11,173 11,173.2 0 0 11,173.2 Notes WBS Definition-Lay out final design for TAB cards. 120 hours of Columbia engineer at \$3724.40/w = \$11,173.20 Labor BOE-Based on layout time for final STT FRC - 3 weeks. Multiplied by a factor of 2 to account for increased board complexity.

WBS		Name					Start	Fir	nish	M&S EQ	M&S Labor	FNAL La	bor	Total Cost
1.2.1.3.12		Fabricate/Asse	mple pre-pr	oduction	TAB		12/23/03	2/26	5/04	\$10,000	\$1,707		\$0	\$11,707
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	8	ElecTechU	10%	\$0	\$0	\$0	\$0	32 h	0 h	0 h	0 h	32 h	-	
	15	MandS	11,706.56	\$11,707	\$0	\$0	\$11,707	11,706.56		0	0	11,706.56		

Notes

WBS Definition-

Fabricate and assemble 2 TABs with final design.

M&S BOE -

\$10,000 in equipment, plus

32 hours of university electrical tech at \$2133.33/w = \$1,706.66

total = \$11,706.66

Labor BOE-

Based on Fab/Assembly time for STT FRC - 4 weeks. Multiplied by a factor of 2 to account for increased board complexity.

1.2.1.3.13		Bench test pre-	-production	TAB			2/27/04	4	4/8/04	\$0	\$7,98	34	\$0	\$7,984
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	4	ElecEngU	30%	\$0	\$0	\$0	\$0	72 h	0 h	0 h	0 h	72 h		
	8	ElecTechU	10%	\$0	\$0	\$0	\$0	24 h	0 h	0 h	0 h	24 h		
	10	PhysicistU	30%	\$0	\$0	\$0	\$0	72 h	0 h	0 h	0 h	72 h		
	13	StudentU	75%	\$0	\$0	\$0	\$0	180 h	0 h	0 h	0 h	180 h		
	15	MandS	7.983.84	\$7.984	\$0	\$0	\$7.984	7.983.84		0	0	7.983.84		

Notes

WBS Definition-

Repeat prototype bench tests for pre-production boards.

M&S BOE

72 hours of Columbia electrical engineer at \$3724.40/w = \$6,703.92, plus

24 hour of Columbia electrical tech at \$2133.33/w = \$1,280.00

total = \$7,983.92

Labor BOE-

Based on test time for first production STT FRC. Multiplied by a factor of 2 to account for increased board complexity.

1.2.1.3.14		Final design a	nd layout o	hanges	to TAB		5/13/04		5/26/04	\$0	\$3,	724	\$0	\$3,724
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	4	ElecEngU	50%	\$0	\$0	\$0	\$0	40 h	0 h	0 h	0 h	40 h		
	15	MandS	3,724.4	\$3,724	\$0	\$0	\$3,724	3,724.4		0	0	3,724.4		

ivotes

NBS Definition-

Final changes to TAB design and layout based on pre-prod tests. Much of this will happen as the testing proceeds.

M&S BOE -

40 hours of Columbia engineer at \$3724.40/w = \$3,724.40

abor BOE

Based on changes necessary at the last stage of the STT FRC production. Multiplied by a factor of 2 to take into account increased board complexity.

1.2.1.3.15		Fabricate prod	uction TAB				5/27/04	7/23	3/04	\$15,000	\$1,707		\$0	\$16,707
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	8	ElecTechU	10%	\$0	\$0	\$0	\$0	32 h	0 h	0 h	0 h	32 h	_	
	15	MandS	16 706 56	\$16 707	\$0	\$0	\$16.707	16.706.56		0	0	16 706 56		

Notes

WBS Definition-

Fabricate and assemble production TAB

M&S BOE -

WBS Start Finish M&S EQ M&S Labor **FNAL Labor Total Cost** Name "Fabricate production TAB" continued equipment = \$15,000 plus 32 hours of university technician at \$2133.33/w = \$1,706.66 total = \$16,706.66 1.2.1.3.16 Bench test production TAB 7/26/04 10/18/04 \$0 \$3.515 \$0 \$3.515 Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work Resource Name Units Cost Baseline Cost Act. Cost **ElecEngU** 5% \$0 \$0 \$0 \$0 24 h 0 h 0 h 24 h 0 h **ElecTechU** 5% \$0 \$0 \$0 \$0 24 h 0 h 0 h 0 h 24 h 20% \$0 \$0 \$0 \$0 13 StudentU 96 h 0 h 0 h 0 h 96 h 15 MandS 3,514.56 \$3,515 \$0 \$0 \$3,515 3,514.56 0 0 3,514.56 Notes WBS Definition-Test full functionality of production boards at Nevis labs. Using simulated inputs, verify that all outputs of the board are as expected and that bit error rate in outputs acceptable -corresponding to approximately 1 fatal error per day at the nominal data volume. M&S BOE -24 hours of Columbia electrical engineer at \$3724.40/w = \$2.234.64 plus 24 hours of Columbia technician at \$2133.33/w = \$1,280.00 total = \$3,514.64Labor BOE-Based on experience in testing final STT FRCs. Assume 1 week continuous tests per board (10 boards) + 2 weeks general tests and setup 1.2.1.4 Global Algorithm Board (GAB) 7/29/02 2/7/05 \$20,000 \$96,964 \$0 \$116,964 Notes WBS Definition-This summary element covers the Global Algorithm Board which receives cluster information from the TAB's, performs final counts jets, EM and tau clusters above specified thresholds, calculates global sums (Et and missing Et) from TAB sums and exports trigger decisions to the TFW. The GAB also provides an interface and fanout for timing and control signal from the trigger framework for the TABs. 1.2.1.4.1 7/29/02 11/18/02 \$0 \$59.590 \$0 \$59,590 Design prototype GAB ID Resource Name Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work 4 ElecEngU 100% \$0 \$0 \$0 \$0 208 h 0 h 0 h 112 h 96 h 15 MandS \$59,590 \$0 14,897.6 59,590.4 \$59,590 \$0 59,590.4 0 44,692.8 WBS Definition-Design a full prototype of the GAB. M&S BOE -640 hours of Columbia engineer at \$3724.40/w = \$59.590.40 Estimated from time required to design prototype STT FRC and BC. These boards have similar functionality to that required for the GAB. 1.2.1.4.2 \$0 \$7,449 \$0 Layout prototype GAB 11/19/02 12/18/02 \$7,449 ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work ElecEngU 50% 80 h \$0 \$0 \$0 \$0 80 h 0 h 0 h MandS 15 7,448.8 \$7,449 \$0 \$0 \$7,449 7,448.8 0 0 7,448.8

Notes

WBS Definition-

Lay out prototype design for GAB.

M&S BOE -

80 hours of Columbia engineer at \$3724.40/w = \$7,448.80

Labor BOE-

Based on layout time for STT FRC - 4 weeks.

WBS		Name					Start	t	Finish	M&S EQ	M&S La	bor FN	IAL Labor	Total Cost
1.2.1.4.3		Procure protot	ype GAB ı	parts			12/5/02	2	2/24/03	\$7,500	\$2,	133	\$0	\$9,633
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	8	ElecTechU	10%	\$0	\$0	\$0	\$0	40 h	0 h	0 h	0 h	40 h		
	15	MandS	9,633.2	\$9,633	\$0	\$0	\$9,633	9,633.2		0	0	9,633.2	1	

Notes

WBS Definition-

Procure all parts for prototype of GAB cards.

M&S BOE-

Costs for the prototype GAB are based on STT FRC cost including motherboard, BC and Link Transmitter Board. FRC costs have been multiplied by a factor of 3 to take into account the small quantity purchases required here. These components cover the basic functionality required of the GAB. Details of the components going into this cost estimate are available in the supporting material folder. Contingency is assigned based on the conceptual nature of the current GAB design.

Equipment cost = \$7500, plus

40 hours of a university technican at \$2133.33/w = \$2133.33

total = \$9,633.33

Labor BOE-

Average amount of effort needed for procurement at Fermilab, based on experience of M. Johnson. Time required based on experience with long lead-time electronics purchases.

1.2.1.4.4		Farbricate/Asse	emble Prote	otype GA	AΒ		2/25/03	3.	/24/03	\$4,500	\$85	53	\$0	\$5,353
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	8	ElecTechU	10%	\$0	\$0	\$0	\$0	16 h	0 h	0 h	0 h	16 h		
	15	MandS	5,353.28	\$5,353	\$0	\$0	\$5,353	5,353.28		0	0	5,353.28		

Notes

WBS Definition-

Fabricate one prototype card.

M&S BOE -

equipment = \$4,500, plus

16 hours of university electrical techician at \$2133.33/w = \$853.33

total = \$5,353.33

Labor BOE-

Based on Fab/Assembly time for STT FRC - 4 weeks.

1.2.1.4.5		Test Prototype	GAB				3/25/03		7/16/03	\$0	\$7,	666	\$0	\$7,666
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	4	ElecEngU	10%	\$0	\$0	\$0	\$0	64 h	0 h	0 h	0 h	64 h		
	8	ElecTechU	5%	\$0	\$0	\$0	\$0	32 h	0 h	0 h	0 h	32 h		
	10	PhysicistU	10%	\$0	\$0	\$0	\$0	64 h	0 h	0 h	0 h	64 h		
	13	StudentU	25%	\$0	\$0	\$0	\$0	160 h	0 h	0 h	0 h	160 h		
	15	MandS	7,665.6	\$7,666	\$0	\$0	\$7,666	7,665.6		0	0	7,665.6		
	Mataa													

MRS Definition

Test prototype GAB by sending control signals to prototype TAB, receiving cluster information from TAB and producing the correct TFW output. Task is only complete when full TAB functionality has also been tested.

M&S BOE -

64 hours of Columbia engineer at \$3724.40/w = \$5,959.04

plus 32 hours of Columbia electrical tech at \$2133.33/w = \$1,706.66

total = \$7,665.70

Labor BOE-

Based on the amount of effort required to integrate the STT FRC and BC cards. Multiplied by a factor of 2 to account for increased complexity.

.2.1.4.6		Name					Start	Finish	M&S EQ	M&S Labor	FNAL		Total Cost
2.1.4.0		L1 Calorimet	ter Trigger	GAB Pro	totype Comp	lete	7/16/03	7/16/03	\$0	\$0		\$0	\$0
	Notes WRS D	efinition-											
			complete and	passes ber	nch tests: produce	s all the corre	ect outputs for kn	nown inputs or failures ur	nderstood.				
.2.1.4.7		Final GAB de	sign				10/10/03	11/6/03	\$0	\$2,980		\$0	\$2,980
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work Ovt. Work	Baseline Work		em. Work	• •	, ,
	4	ElecEngU	20%	\$0	\$0 \$0	\$0	\$0	32 h 0 l	h 0 h	0 h 0	32 h		
	15	MandS	2,979.52	\$2,980	\$0	\$0	\$2,980	2,979.52	Ü	Ü	2,979.52		
	Notes WBS D	efinition-											
		prototype design to	o address any	shortcomin	gs found in testing	g.							
	M&S B	OF-											
		rs of Columbia engi	ineer at \$3724.	.40/w = \$2,	979,52								
	Labor E	ROF-											
		ted from time requir	red to impleme	nt final cha	nges to FRC desi	gn after testin	ıg.						
.2.1.4.8		Procure GAB	parts				11/7/03	1/29/04	\$5,000	\$2,133		\$0	\$7,133
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work Ovt. Work	Baseline Work		Work		
	8 15	ElecTechU MandS	10% 7,133.2	\$0 \$7,133	\$0 \$0	\$0 \$0	\$0 \$7,133	40 h 0 h 7,133.2	0 h 0	0 h 0	40 h 7,133.2		
	Notes		7,700.2	ψ1,100	40	40	<i>\$7,100</i>	7,700.2	· ·	v	7,700.2		
		efinition-											
	M&S B	OE-											
	going ir		te are available	e in the sup	porting material			smitter Board. These co	mponents cover the	basic functionality r	required of th	he GAB. Det	ails of the compo
	Costs f going in folder.	or the prototype GA nto this cost estima	te are available signed based o	e in the sup in the conc	porting material eptual nature of th			smitter Board. These co	mponents cover the	basic functionality r	required of th	he GAB. Det	ails of the compo
	Costs f going in folder. Parts fo 40 hour	for the prototype GA nto this cost estima Contingency is ass or 2 boards = \$5,00	te are available signed based o	e in the sup in the conc	porting material eptual nature of th			smitter Board. These co	mponents cover the	basic functionality r	required of th	he GAB. Det	ails of the compo
	Costs f going in folder. Parts fo 40 hour	or the prototype GA nto this cost estimar Contingency is ass or 2 boards = \$5,00 or of university eletrication 7,133.33	te are available signed based o	e in the sup in the conc	porting material eptual nature of th			smitter Board. These co	mponents cover the	basic functionality i	required of th	he GAB. Det	ails of the compo
	Costs f going in folder. Parts for 40 hour total \$7	or the prototype GA nto this cost estimal Contingency is ass or 2 boards = \$5,00 or of university eletrications '7,133.33	te are available signed based o 10 plus cal technician (e in the sup in the conco @ \$2133.3	porting material eptual nature of th 3/w = \$2133.33	e current GAI	B design.	smitter Board. These co		Í			ails of the compo
.2.1.4.9	Costs f going in folder. Parts for 40 hour total \$7	or the prototype GA nto this cost estimal Contingency is ass or 2 boards = \$5,00 or of university eletrications '7,133.33	te are available signed based o 0 plus cal technician (e in the sup in the conco @ \$2133.3	porting material eptual nature of th 3/w = \$2133.33	e current GAI	B design.			Í			ails of the compo
.2.1.4.9	Costs f going in folder. Parts fc 40 hour total \$7 Labor E Averag	or the prototype GA nto this cost estimar Contingency is ass or 2 boards = \$5,00 or of university eletrication (1,133.33) BOE- e amount of effort r Layout final G Resource Name	te are available signed based on the process of the	e in the sup in the conco @ \$2133.3 curement a	porting material aptual nature of th 3/w = \$2133.33 t Fermilab, based	on experienc	e of M. Johnson. 11/7/03 Rem. Cost	. Time required based or 12/22/03 Work Ovt. Work	n experience with lo \$0 Baseline Work	ng lead-time electro \$4,469 Act. Work Re	nics purchas	ses.	
.2.1.4.9	Costs f going in folder. Parts fc 40 hour	or the prototype GA nto this cost estima: Contingency is ass or 2 boards = \$5,00 or of university eletrications capacity in the second of the	te are available signed based on the process of the	e in the sup in the conci @ \$2133.3 curement a	porting material aptual nature of th 3/w = \$2133.33 t Fermilab, based Baseline Cost	on experienc Act. Cost	e of M. Johnson 11/7/03 Rem. Cost	. Time required based of 12/22/03 Work Ovt. Work 48 h	n experience with lo \$0 Baseline Work	ng lead-time electro \$4,469	nics purchas em. Work 48 h	ses.	
.2.1.4.9	Costs f going in folder. Parts for 40 hour	or the prototype GA nto this cost estimar Contingency is ass or 2 boards = \$5,00 or of university eletrication (1,133,33) BOE- e amount of effort r Layout final G Resource Name ElecEngU MandS	te are available signed based on the process of the	e in the sup in the conco @ \$2133.3 curement a	porting material aptual nature of th 3/w = \$2133.33 t Fermilab, based	on experienc	e of M. Johnson. 11/7/03 Rem. Cost	. Time required based or 12/22/03 Work Ovt. Work	n experience with lot \$0 Baseline Work h 0 h	ng lead-time electro \$4,469 Act. Work Re 0 h	nics purchas	ses.	
.2.1.4.9	Costs f going in folder. Parts for 40 hour	or the prototype GA nto this cost estimar Contingency is ass or 2 boards = \$5,00 or of university eletrication (1,133,33) BOE- e amount of effort r Layout final G Resource Name ElecEngU MandS	te are available signed based on the process of the	e in the sup in the conci @ \$2133.3 curement a	porting material aptual nature of th 3/w = \$2133.33 t Fermilab, based Baseline Cost	on experienc Act. Cost	e of M. Johnson 11/7/03 Rem. Cost	. Time required based of 12/22/03 Work Ovt. Work 48 h	n experience with lot \$0 Baseline Work h 0 h	ng lead-time electro \$4,469 Act. Work Re 0 h	nics purchas em. Work 48 h	ses.	
.2.1.4.9	Costs f going in folder. Parts for 40 hour total \$7 Labor E Averag ID 4 15 Notes WBS D	or the prototype GA nto this cost estima: Contingency is ass or 2 boards = \$5,00 or of university eletrications or 2,133.33 BOE- e amount of effort r Layout final G Resource Name ElecEngU MandS	te are available signed based of plus cal technician (speeded for processing the second for proc	e in the sup in the conci @ \$2133.3 curement a	porting material aptual nature of th 3/w = \$2133.33 t Fermilab, based Baseline Cost	on experienc Act. Cost	e of M. Johnson 11/7/03 Rem. Cost	. Time required based of 12/22/03 Work Ovt. Work 48 h	n experience with lot \$0 Baseline Work h 0 h	ng lead-time electro \$4,469 Act. Work Re 0 h	nics purchas em. Work 48 h	ses.	
I.2.1.4.9	Costs f going in folder. Parts for 40 hour	or the prototype GA nto this cost estima: Contingency is ass or 2 boards = \$5,00 or of university eletrications or 2,133.33 BOE- e amount of effort r Layout final G Resource Name ElecEngU MandS Definition- t final design for TA OE -	te are available signed based of plus cal technician of the process of the proces	e in the sup in the conce @ \$2133.3 curement a Cost \$0 \$4,469	porting material aptual nature of the state	on experienc Act. Cost	e of M. Johnson 11/7/03 Rem. Cost	. Time required based of 12/22/03 Work Ovt. Work 48 h	n experience with lot \$0 Baseline Work h 0 h	ng lead-time electro \$4,469 Act. Work Re 0 h	nics purchas em. Work 48 h	ses.	
.2.1.4.9	Costs f going in folder. Parts for 40 hour	or the prototype GA nto this cost estimar Contingency is ass or 2 boards = \$5,00 or of university eletrication (1,133.33) BOE- e amount of effort r Layout final G Resource Name ElecEngU MandS Definition- t final design for TA OE - or of university eletrication (1,233.33) OF (1,333.33) OF (1,33	te are available signed based of plus cal technician of the process of the proces	e in the sup in the conce @ \$2133.3 curement a Cost \$0 \$4,469	porting material aptual nature of the state	on experienc Act. Cost	e of M. Johnson 11/7/03 Rem. Cost	. Time required based of 12/22/03 Work Ovt. Work 48 h	n experience with lot \$0 Baseline Work h 0 h	ng lead-time electro \$4,469 Act. Work Re 0 h	nics purchas em. Work 48 h	ses.	
.2.1.4.9	Costs f going in folder. Parts fo 40 hour	or the prototype GA nto this cost estimar Contingency is ass or 2 boards = \$5,00 or of university eletrication (1,133,33) BOE- e amount of effort r Layout final G Resource Name ElecEngU MandS Definition- t final design for TA OE - rs of Columbia enging BOE-	te are available signed based of plus cal technician of the process of the proces	e in the sup in the conce @ \$2133.3 curement a Cost \$0 \$4,469	porting material eptual nature of the state	on experienc Act. Cost \$0 \$0	e of M. Johnson. 11/7/03 Rem. Cost \$0 \$4,469	. Time required based of 12/22/03 Work Ovt. Work 48 h	n experience with lot \$0 Baseline Work 0 0 0	ng lead-time electro \$4,469 Act. Work Re 0 h	nics purchas em. Work 48 h	ses.	
	Costs f going ir folder. Parts fo 40 hour	or the prototype GA nto this cost estimar Contingency is ass or 2 boards = \$5,00 or of university eletrication (1,133,33) BOE- e amount of effort r Layout final G Resource Name ElecEngU MandS Definition- t final design for TA OE - rs of Columbia enging BOE-	te are available signed based of plus cal technician of the process of the proces	e in the sup in the conce @ \$2133.3 curement a	porting material eptual nature of the state	on experienc Act. Cost \$0 \$0	e of M. Johnson. 11/7/03 Rem. Cost \$0 \$4,469	. Time required based of 12/22/03 Work Ovt. Work 48 h 4,469.28	n experience with lot \$0 Baseline Work 0 0 0	ng lead-time electro \$4,469 Act. Work Re 0 h	nics purchas em. Work 48 h	ses.	
1.2.1.4.9	Costs f going ir folder. Parts fo 40 hour	or the prototype GA nto this cost estima Contingency is ass or 2 boards = \$5,00 or of university eletrication (1,133.33 BOE- e amount of effort or Layout final G Resource Name ElecEngU MandS Definition- t final design for TA OE - or of Columbia enging BOE- on layout time for fi	te are available signed based of plus cal technician of the process of the proces	e in the sup in the conce @ \$2133.3 curement a	porting material eptual nature of the state	on experienc Act. Cost \$0 \$0	e of M. Johnson. 11/7/03 Rem. Cost \$0 \$4,469	. Time required based or 12/22/03 Work Ovt. Work 48 h 0 1 4,469.28	n experience with low \$0 Baseline Work n 0 h 0	ng lead-time electro \$4,469 Act. Work Re 0 h 0	nics purchas em. Work 48 h	ses. \$0	\$4,469

WBS Name Start Finish M&S EQ M&S Labor FNAL Labor Total Cost

"Fabricate production GAB" continued

Notes

WBS Definition-

Fabricate and assemble production GAB

M&S BOE -

Fabricate/Assemble 2 boards = \$3,000, plus

32 hours of university tecnician \$2133.33/w = \$1706.66

total = \$4,706.66

Labor BOE-

Based on Fab/Assembly time for STT FRC - 4 weeks. Multiplied by a factor of 2 to account for increased board complexity.

1.2.1.4.11 \$0 \$0 12/16/04 2/7/05 \$7,984 \$7,984 Bench test production GAB Resource Name Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work ElecEngU 30% \$0 \$0 \$0 \$0 72 h 0 h 0 h 0 h 72 h ElecTechU 10% \$0 \$0 \$0 \$0 24 h 0 h 24 h 0 h 0 h 10 PhysicistU 30% \$0 \$0 \$0 \$0 72 h 0 h 72 h 0 h 0 h 13 StudentU 75% \$0 \$0 \$0 \$0 180 h 0 h 0 h 0 h 180 h 15 MandS 7,983.84 \$7,984 \$0 \$0 \$7,984 7,983.84 0 7,983.84

Notes

WBS Definition-

Test full functionality of production boards at Nevis labs with pre-production TABs. Using simulated inputs, verify that all outputs of the board are as expected and that bit error rate in outputs acceptable - corresponding to approximately 1 fatal error per day at the nominal data volume.

M&S BOF

72 h of Columbia electrical engineer at \$3724.40/w = \$6703.92 plus

24 hours of Columbia technician at \$2133.33/w = \$1280.00

total = \$7,983.92

Labor BOE-

Based on test time for first production STT FRC and BC. Multiplied by a factor of 2 to account for increased system complexity.

1.2.1.5		Cables					9/9/02	1	11/1/04	\$20,781	\$4,0	50	\$0	\$24,831
		Definition- ger cables												
1.2.1.5.1		Design and Fa	bricate sys	tem to te	st ADF to TAE	3 cable	9/9/02	10	0/18/02	\$3,000	\$42	27	\$0	\$3,427
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	8	ElecTechU	3%	\$0	\$0	\$0	\$0	8 h	0 h	0 h	7.2 h	0.8 h		

3,426.64

342.66

3,083.98

\$0

15 MandS 3,426.64
Notes

WBS Definition-

Fabricate test cards (receiver and transmitter) plus sample cables to test cable and Channel Link chip characteristics using HP signal generator.

\$3,427

\$0

M&S BOE

Cost based on similar test systems made at Nevis for cable tests.

Equipment = \$3000 plus

8 hours of Columbia technician at \$2133.33/w = \$427.00

total = \$3,427.00

Labor BOE-

Duration based on average amount of time for similar test systems made at Nevis.

\$3,427

.2.1.5.2		Name					Start	Finish	M&S EQ	M&S Labor	FNAL L	.abor	Total Cost
		Test ADF to Ta	AB cables				10/21/02	11/1/02	\$0	\$1,490		\$0	\$1,490
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work Ovt. Wo			Rem. Work		
	4 13	ElecEngU StudentU	20% 50%	\$0 \$0	\$0 \$0	\$0 \$0	\$0 \$0		0 h 0 h 0 h	0 h 0 h	16 h 40 h		
	15	MandS	1,489.76	\$1,490	\$0	\$0	\$1,490	1,489.76	0	0	1,489.76		
	Notes												
		Definition- DF to TAB cable prop	perties using s	signal gene	ator at Nevis. Cal	oles must exh	bit acceptable s	gnal degradation (no	bit-errors) when run a	t the rate foreseer	n in the L1Cal	(384 MHz).	
	M&S B 16 hou	OE - rs of Columbia engin	neer at \$3724.	40/w = \$1,4	89.76								
	Labor E Based	BOE- on the amount of effo	ort required fo	r similar ca	ble tests at Nevis.								
1.2.1.5.3		Procure ADF to	o TAB cabl	es			8/23/04	11/1/04	\$17,781	\$2,133		\$0	\$19,914
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work Ovt. W			Rem. Work		
	8 15	ElecTechU MandS	10% 19,914.1	\$0 \$19,914	\$0 \$0	\$0 \$0	\$0 \$19,914	40 h 19,914.1	0 h 0 h		40 h 19,914.1		
		Definition- use all cables + spare	on required for	the L1 Col	avatam								
	40 hou	bles + 30 spares are rs of Columbia techn - \$19,914.23				= \$17,780.90	plus						
	Labor E	BOE-							lab				
1216		on based on average			procurement. La	bor based on				\$11 729		\$0	\$35 429
1.2.1.6		TAB Crates a			procurement. La	bor based on	8/23/02	12/15/04	\$23,700	\$11,729		\$0	\$35,429
1.2.1.6	Duratio	TAB Crates a			procurement. La	bor based on				\$11,729		\$0	\$35,429
	Duratio	TAB Crates at	nd Service	s		bor based on				\$11,729 \$3,413		\$0	\$35,429 \$11,513
	Notes WBS D	TAB Crates at Definition-	nd Service	s totype T/	AB/GAB Baseline Cost	Act. Cost	8/23/02 8/23/02 Rem. Cost	12/15/04 12/17/02 Work Ovt.	\$23,700 \$8,100 Work Baseline Work	\$3,413 Act. Work	Rem. Work	\$0	
1.2.1.6 1.2.1.6.1	Notes WBS D	TAB Crates and selection based on average TAB Crates and selection before the control of the co	erate for pro	sototype TA	AB/GAB Baseline Cost \$0	Act. Cost	8/23/02 8/23/02 Rem. Cost \$0	12/15/04 12/17/02 Work Ovt. 64 h	\$23,700 \$8,100 Work Baseline Work	\$3,413 Act. Work 0 h 12.8 h	51.2 h	\$0	
	Notes WBS D	TAB Crates and Definition- Procure TAB Crates and Definition- Procure TAB Crates and Definition- Resource Name ElecTechU MandS	nd Service	s totype T/	AB/GAB Baseline Cost \$0	Act. Cost	8/23/02 8/23/02 Rem. Cost \$0	12/15/04 12/17/02 Work Ovt.	\$23,700 \$8,100 Work Baseline Work	\$3,413 Act. Work		\$0	
	Notes WBS D	TAB Crates and Definition- Procure TAB Crates and Definition- Procure TAB Crates and Definition- Resource Name ElecTechU MandS	erate for pro	sototype TA	AB/GAB Baseline Cost \$6	Act. Cost	8/23/02 8/23/02 Rem. Cost \$0	12/15/04 12/17/02 Work Ovt. 64 h	\$23,700 \$8,100 Work Baseline Work	\$3,413 Act. Work 0 h 12.8 h	51.2 h	\$0	
	Notes WBS D ID 8 15 Notes WBS D	TAB Crates and a contract of the contract of t	crate for pro Units 10% 11,513.12	totype T/ Cost \$0 \$11,513	AB/GAB Baseline Cost \$0 \$0	Act. Cost \$0 \$11,513	8/23/02 8/23/02 Rem. Cost \$0 \$0	12/15/04 12/17/02 Work Ovt. 64 h	\$23,700 \$8,100 Work Baseline Work	\$3,413 Act. Work 0 h 12.8 h	51.2 h	\$0	
	Notes WBS D ID 8 15 Notes WBS D Reproduction M&S B Cost (\$ Equipm	TAB Crates at Definition- Procure TAB CRESCURE Name ElecTechU MandS Definition- e one 9U VME crate	erate for pro Units 10% 11,513.12 + VIPA backp	totype T/ Cost \$0 \$11,513	AB/GAB Baseline Cost \$0 \$0 \$0 so e in testing prototy	Act. Cost \$0 \$11,513 /pe TABs and	8/23/02 8/23/02 Rem. Cost \$0 \$0 GABs at Nevis.	12/15/04 12/17/02 Work Ovt. 64 h 11,513.12	\$23,700 \$8,100 Work Baseline Work	\$3,413 Act. Work 12.8 h 0 2,302.62	51.2 h 9,210.5	\$0	\$11,513
	Notes WBS D ID 8 15 Notes WBS D Procure M&S B Cost (\$ Equipm 64 hou	TAB Crates at Definition- Procure TAB Crates at ElecTechU MandS Definition- Defi	erate for pro Units 10% 11,513.12 + VIPA backp	totype T/ Cost \$0 \$11,513	AB/GAB Baseline Cost \$0 \$0 \$0 so e in testing prototy	Act. Cost \$0 \$11,513 /pe TABs and	8/23/02 8/23/02 Rem. Cost \$0 \$0 GABs at Nevis.	12/15/04 12/17/02 Work Ovt. 64 h 11,513.12	\$23,700 \$8,100 Work Baseline Work 0 h	\$3,413 Act. Work 12.8 h 0 2,302.62	51.2 h 9,210.5	\$0	\$11,513
	Notes WBS D ID 8 15 Notes WBS D Procure M&S B Cost (\$ Equipm 64-hou- total =	TAB Crates all Definition- Procure TAB of Resource Name ElecTechU MandS Definition- e one 9U VME crate (OE- 18,100) based on simment = \$8100 plus rs of Columbia technisms of Columbia technisms. BOE- \$11,513.33	erate for pro Units 10% 11,513.12 + VIPA backp	stotype T/ Cost \$0 \$11,513 solane for use ckplane pure 3.33/w = \$3	AB/GAB Baseline Cost \$6 \$6 \$6 are in testing prototy chased for STT sy 413.33	Act. Cost \$0 \$11,513 rpe TABs and rstem. Crate (s	8/23/02 8/23/02 Rem. Cost \$0 \$0 \$0 GABs at Nevis.	12/15/04 12/17/02 Work Ovt. 64 h 11,513.12 as \$4690 while VIPA	\$23,700 \$8,100 Work Baseline Work 0 h	\$3,413 Act. Work 12.8 h 0 2,302.62 . Power supply wi	51.2 h 9,210.5	\$0	\$11,513

1.2.1.6.2		Procure VME	CPU for pro	ototype T	AB/GAB		10/7/02	1	2/3/02	\$3,250	\$1,70)7	\$0	\$4,957
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	8	ElecTechU	10%	\$0	\$0	\$0	\$0	32 h	0 h	0 h	0 h	32 h		
	15	MandS	4,956.56	\$4,957	\$0	\$0	\$4,957	4,956.56		0	0	4,956.56		

WBS Name Start Finish M&S EQ M&S Labor FNAL Labor Total Cost

"Procure VME CPU for prototype TAB/GAB" continued

Notes

WBS Definition-

Procure one VME CPU for use in testing prototype TABs and GABs at Nevis.

M&S BOE-

Cost based on similar CPU purchased for STT system.

Equipment = \$3250 plus

32 hours of university technician at \$2133.33/w = \$1706.66

total = \$4,956.66

Labor BOE-

Duration based on amount of time required to purchase CPUs for the STT project. Labor based on average effort for purchases at Fermilab.

1.2.1.6.3 Specify TAB crate/power/cooling 4/20/04 5/3/04 \$0 \$1,490

ID Units Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work Resource Name Cost Baseline Cost Act. Cost \$0 ElecEngU 20% \$0 \$0 \$0 16 h 0 h 0 h 0 h 16 h 15 MandS 1,489.76 \$1,490 \$0 \$0 \$1,490 1,489.76 0 0 1,489.76

Notes

WBS Definition-

Produce final specification for power, cooling and related services for TAB/GAB crate to be used at Fermilab.

M&S BOE-

Time estimate takes into account two iterations with Fermilab engineers on these spec's. Cost is based on 16 hours of university engineer at \$3891.30/w = \$1,556.52

1.2.1.6.4 Procure TAB crate 8/23/04 12/15/04 \$9.100 \$3.413 \$0 \$12,513 ID Resource Name Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work Cost 8 ElecTechU 10% \$0 \$0 \$0 \$0 64 h 0 h 0 h 0 h 64 h \$0 \$0 15 MandS 12,513.12 \$12,513 \$12,513 12,513.12 0 0 12,513.12

\$0

\$0

\$1,490

\$4,957

Notes

WBS Definition-

Procure one 9U VME crate + VIPA backplane for use in final system at Fermilab.

M&S BOE-

Cost based on similar crate+backplane purchased for STT system. Crate (sub-rack) cost was \$4690 while VIPA backplane was \$3410. Power supply and cooling estimated to cost \$1000 based on similar components in L1muon system.

Equipment = \$9100 plus

64 hours of electrical tech at \$2133.33/w = \$3413.33

total = 12,513.33

Labor BOE-

Duration based on amount of time required to purchase similar crates for the STT project. Labor based on average effort for purchases at Fermilab.

Procure TAB VME CPU 8/23/04 10/18/04 \$3,250 \$1,707 Baseline Work Act. Work ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Rem. Work 8 ElecTechU 10% \$0 \$0 \$0 \$0 32 h 0 h 0 h 0h32 h 15 \$4,957 \$0 MandS 4,956.56 \$0 \$4,957 4,956.56 4,956.56

Notes

1.2.1.6.5

WBS Definition-

Procure one VME CPU for use in TAB/GAB crate at Fermilab.

M&S BOE-

Cost based on similar CPU purchased for STT system (\$3250)

Equipment = \$3250 plus

32 hour of university technical at \$2133.33/w = \$1706.66

total = \$4,956.66

		Name					Start	F	inish	M&S EQ	M&S Labor	FNAL	Labor	Total Cost
Procure T	TAB VIV	IE CPU" continu	ied											
	Notes Labor E													
		on based on amount	of time requir	ed to purcha	ase CPUs for the	STT project. I	abor based on	average effo	rt for purchase	es at Fermilab.				
							=/40/00							
.2.1.7		L1 Calorimete	er i rigger	I AB/GAE	3 Prototyping	Com	7/16/03	71	16/03	\$0	\$0		\$0	\$0
	Notes WRS D	efinition-												
		ne. Achieved when	8 production ⁻	TABs and 1	production GAB	pass all bench	ımark tests.							
.2.1.8		L1 Calorimete	er Triager	TAR/GAE	R Production	and T	2/7/05	2	2/7/05	\$0	\$0		\$0	\$0
.2.1.0	Notes		ci iliggei	IADIOAL	3 i Toddection	ana i	2/1/00	•		ΨΟ	ΨΟ		ΨΟ	Ψ
	WBS D	efinition-												
	Milesto	ne. Achieved when	8 production ⁻	TABs and 1	production GAB	pass all bench	ımark tests.							
.2.1.9		Prototype Int	egration				12/4/02	10	/9/03	\$0	\$44,949	\$	2,496	\$47,445
	Notes	• • •	3							**	¥ 1 1,0 10	Ť	_,	4 11 , 112
	WBS D	efinition-												
	This su	ımmary task describ	es the first sta	age of a seri	es of tests which	combine diffe	rent boards and	eventually th	ie DZero trigg	er framework (TFW	 to ensure that 	they all work	together pro	perly.
	Risk Mi	itigation (schedule)-												
			aking longer th	nan expecte	d is reduced by p	utting this task	as early in the	project as po	ssible. Additio	onally, prototype int	egration tests a	re planned to i	mimic as clo	osely as possible data
	taking i	in the D0 environme	nt, including t	he use of re	al data from the E	BLS (via splitte	er cards) and rea	il timing sign	als from the T	rigger Framework.				
2.1.9.1		Develop in-situ	u exercizino	a/debugai	ng software		12/4/02	5	5/2/03	\$0	\$16,494		\$0	\$16,494
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work	**	4 : 2 , : 2 :
	4	ElecEngU	50%	\$0	\$0	\$0	\$0	400 h	0 h	0 h			_	
					Φ 0	90					0 h	400 h		
	10 15	PhysicistU	50%	\$0	\$0	\$0	\$0	400 h	0 h		0 h 0 h	400 h		
	15	PhysicistU MandS			\$0 \$0	\$0				0 h	0 h			
	15 Notes	PhysicistU MandS	50%	\$0	\$0	\$0	\$0	400 h		0 h	0 h	400 h		
	15 Notes WBS D	PhysicistU MandS	50% 16,494.4	\$0 \$16,494	\$0 \$0	\$0 \$0	\$0 \$16,494	400 h 16,494.4	0 h	0 h 0	0 h	400 h		
	Notes WBS D Develo	PhysicistU MandS Definition- p special in situ test	50% 16,494.4	\$0 \$16,494	\$0 \$0	\$0 \$0	\$0 \$16,494	400 h 16,494.4	0 h	0 h 0	0 h	400 h		
	Notes WBS D Develo	PhysicistU MandS Definition- p special in situ test	50% 16,494.4 and diagnost	\$0 \$16,494 ic software t	\$0 \$0 that cycles the sy	\$0 \$0	\$0 \$16,494	400 h 16,494.4	0 h	0 h 0	0 h	400 h		
	Notes WBS D Develop M&S B 400 hor	PhysicistU MandS Definition- p special in situ test OE- urs of university eng	50% 16,494.4 and diagnost	\$0 \$16,494 ic software t	\$0 \$0 that cycles the sy	\$0 \$0	\$0 \$16,494	400 h 16,494.4	0 h	0 h 0	0 h	400 h		
	Notes WBS D Develop M&S B 400 hor	PhysicistU MandS Definition- p special in situ test OE- urs of university eng	50% 16,494.4 and diagnost gineer at \$412	\$0 \$16,494 ic software t 3.49/w = \$4	\$0 \$0 that cycles the sy 1,234.93	\$0 \$0	\$0 \$16,494	400 h 16,494.4	0 h	0 h 0	0 h	400 h		
	Notes WBS D Develop M&S B 400 hor	PhysicistU MandS Definition- p special in situ test OE- urs of university eng BOE- on similar software of	and diagnost sineer at \$412	\$0 \$16,494 ic software t 3.49/w = \$4 for existing L	\$0 \$0 that cycles the sy 1,234.93 L1Cal.	\$0 \$0	\$0 \$16,494 In speed and veri	400 h 16,494.4 fies that the	0 h hardware gets	o h o	0 h 0	400 h 16,494.4	20	20.000
.2.1.9.2	M&S B 400 hor Labor E	PhysicistU MandS Definition- p special in situ test OE- urs of university eng BOE- on similar software of	and diagnost ineer at \$412 development t	\$0 \$16,494 ic software to 3.49/w = \$4 for existing Lots ADF+TA	that cycles the sy 1,234.93 L1Cal. B:Columbia	\$0 \$0	\$0 \$16,494 In speed and veri	400 h 16,494.4 files that the	0 h hardware gets 13/03	o h o	\$2,980	400 h 16,494.4	\$0	\$2,980
.2.1.9.2	Notes WBS D Develop M&S B 400 hor Labor E Based	PhysicistU MandS Definition- p special in situ test OE- urs of university eng BOE- on similar software of Prototype inter Resource Name	50% 16,494.4 and diagnost ineer at \$412 development to gration test Units	\$0 \$16,494 ic software t 3.49/w = \$4 for existing L : ADF+TA Cost	\$0 \$0 that cycles the sy 1,234.93 L1Cal. B:Columbia Baseline Cost	\$0 \$0 stem at design	\$0 \$16,494 In speed and veri 7/17/03 Rem. Cost	400 h 16,494.4 files that the Work	0 h hardware gets 13/03 Ovt. Work	s the right answer. \$0 Baseline Work	\$2,980 Act. Work	400 h 16,494.4 Rem. Work	\$0	\$2,980
.2.1.9.2	M&S B 400 hor Labor E	PhysicistU MandS Definition- p special in situ test OE- urs of university eng BOE- on similar software of	and diagnost ineer at \$412 development t	\$0 \$16,494 ic software to 3.49/w = \$4 for existing Lots ADF+TA	that cycles the sy 1,234.93 L1Cal. B:Columbia	\$0 \$0	\$0 \$16,494 In speed and veri	400 h 16,494.4 files that the	0 h hardware gets 13/03	o h o s the right answer.	\$2,980	400 h 16,494.4	\$0	\$2,980
.2.1.9.2	Notes WBS D Develop M&S B 400 hor Labor E Based ID 4 10 13	PhysicistU MandS Definition- p special in situ test OE- urs of university eng BOE- on similar software of Prototype integrated in the situation of the situ	and diagnost sincer at \$412 development to gration test Units 20% 50%	\$0 \$16,494 iic software t 3.49/w = \$4 for existing L ADF+TA Cost \$0 \$0 \$0	that cycles the sy 1,234.93 L1Cal. B:Columbia Baseline Cost \$0 \$0 \$0	\$0 \$0 stem at design Act. Cost \$0 \$0 \$0	\$0 \$16,494 In speed and veri 7/17/03 Rem. Cost \$0 \$0 \$0	400 h 16,494.4 files that the 8/ Work 32 h 16 h 80 h	0 h hardware gets 13/03 Ovt. Work 0 h	\$0 b o o o o o o o o o o o o o o o o o o	\$2,980 Act. Work 0 h 0 h	400 h 16,494.4 Rem. Work 32 h 16 h 80 h	\$0	\$2,980
2.1.9.2	Notes WBS D Develop M&S B 400 hor Labor E Based 6	PhysicistU MandS Definition- p special in situ test OE- urs of university eng BOE- on similar software of Prototype inter Resource Name ElecEngU PhysicistU StudentU MandS	and diagnost sincer at \$412 development to gration test Units 20% 10%	\$0 \$16,494 ic software to 3.49/w = \$4 for existing Lost Cost \$0 \$0	that cycles the sy 1,234.93 L1Cal. B:Columbia Baseline Cost \$0 \$0	stem at design Act. Cost \$0 \$0	\$0 \$16,494 In speed and veri 7/17/03 Rem. Cost \$0 \$0	400 h 16,494.4 files that the 8/ Work 32 h 16 h	0 h hardware gets 13/03 Ovt. Work 0 h 0 h	\$0 b o o o o o o o o o o o o o o o o o o	\$2,980 Act. Work	400 h 16,494.4 Rem. Work 32 h 16 h	\$0	\$2,980
2.1.9.2	Notes WBS D Develop M&S B 400 hor Labor E Based ID 4 10 13 15 Notes	PhysicistU MandS Definition- p special in situ test OE- urs of university eng BOE- on similar software of Prototype inter Resource Name ElecEngU PhysicistU StudentU MandS	and diagnost sincer at \$412 development to gration test Units 20% 50%	\$0 \$16,494 iic software t 3.49/w = \$4 for existing L ADF+TA Cost \$0 \$0 \$0	that cycles the sy 1,234.93 L1Cal. B:Columbia Baseline Cost \$0 \$0 \$0	\$0 \$0 stem at design Act. Cost \$0 \$0 \$0	\$0 \$16,494 In speed and veri 7/17/03 Rem. Cost \$0 \$0 \$0	400 h 16,494.4 files that the 8/ Work 32 h 16 h 80 h	0 h hardware gets 13/03 Ovt. Work 0 h 0 h	\$0 b o o o o o o o o o o o o o o o o o o	\$2,980 Act. Work 0 h 0 h	400 h 16,494.4 Rem. Work 32 h 16 h 80 h	\$0	\$2,980
.2.1.9.2	Notes WBS D Develo M&S B 400 hor Labor E Based ID 4 10 13 15 Notes Definition	PhysicistU MandS Definition- p special in situ test OE- urs of university eng BOE- on similar software of Prototype inter Resource Name ElecEngU PhysicistU StudentU MandS On-	50% 16,494.4 and diagnost tineer at \$412 development to gration test Units 20% 10% 50% 2,979.52	\$0 \$16,494 ic software to 3.49/w = \$4 for existing Lost : ADF+TA Cost \$0 \$0 \$0 \$2,980	that cycles the sy 1,234.93 L1Cal. B:Columbia Baseline Cost \$0 \$0 \$0 \$0 \$0 \$0	stem at design Act. Cost SO SO SO SO	\$0 \$16,494 In speed and verification of the speed and verification	400 h 16,494.4 fies that the 8/Work 32 h 16 h 80 h 2,979.52	0 h hardware gets 13/03 Ovt. Work 0 h 0 h 0 h	\$0 Baseline Work 0 h 0 h 0 h 0 h 0 h 0 h 0 h 0 h	\$2,980 Act. Work 0 h 0 h	400 h 16,494.4 Rem. Work 32 h 16 h 80 h 2,979.52	,	\$2,980
.2.1.9.2	Notes WBS D Develo M&S B 400 hor Labor E Based ID 4 10 13 15 Notes Definiting Test pon	PhysicistU MandS Definition- p special in situ test OE- urs of university eng BOE- on similar software of Prototype inter Resource Name ElecEngU PhysicistU StudentU MandS On-	50% 16,494.4 and diagnost tineer at \$412 development to gration test Units 20% 10% 50% 2,979.52	\$0 \$16,494 ic software to 3.49/w = \$4 for existing Lost : ADF+TA Cost \$0 \$0 \$0 \$2,980	that cycles the sy 1,234.93 L1Cal. B:Columbia Baseline Cost \$0 \$0 \$0 \$0 \$0 \$0	stem at design Act. Cost SO SO SO SO	\$0 \$16,494 In speed and verification of the speed and verification	400 h 16,494.4 fies that the 8/Work 32 h 16 h 80 h 2,979.52	0 h hardware gets 13/03 Ovt. Work 0 h 0 h 0 h	\$0 Baseline Work 0 h 0 h 0 h 0 h 0 h 0 h 0 h 0 h	\$2,980 Act. Work 0 h 0 h	400 h 16,494.4 Rem. Work 32 h 16 h 80 h 2,979.52	,	. ,
.2.1.9.2	Notes WBS D Develop M&S B 400 hor Labor E Based of ID 4 10 13 15 Notes Definiting Test pripart of the	PhysicistU MandS Definition- p special in situ test OE- urs of university eng BOE- on similar software of Prototype inter Resource Name ElecEngU PhysicistU StudentU MandS On- ototype TAB with signed the effort.	50% 16,494.4 and diagnost tineer at \$412 development to gration test Units 20% 10% 50% 2,979.52	\$0 \$16,494 ic software to 3.49/w = \$4 for existing Lost : ADF+TA Cost \$0 \$0 \$0 \$2,980	that cycles the sy 1,234.93 L1Cal. B:Columbia Baseline Cost \$0 \$0 \$0 \$0 \$0 \$0	stem at design Act. Cost SO SO SO SO	\$0 \$16,494 In speed and verification of the speed and verification	400 h 16,494.4 fies that the 8/Work 32 h 16 h 80 h 2,979.52	0 h hardware gets 13/03 Ovt. Work 0 h 0 h 0 h	\$0 Baseline Work 0 h 0 h 0 h 0 h 0 h 0 h 0 h 0 h	\$2,980 Act. Work 0 h 0 h	400 h 16,494.4 Rem. Work 32 h 16 h 80 h 2,979.52	,	. ,
.2.1.9.2	Notes WBS D Develo M&S B 400 hor Labor E Based ID 4 10 13 15 Notes Definitir Test propart of M&S B	PhysicistU MandS Definition- p special in situ test OE- urs of university eng BOE- on similar software of Prototype inter Resource Name ElecEngU PhysicistU StudentU MandS On- ototype TAB with signed the effort.	and diagnost sineer at \$412 development to gration test Units 20% 10% 50% 2,979.52 gnals from pro	\$0 \$16,494 ic software to 3.49/w = \$4 for existing L : ADF+TA Cost \$0 \$0 \$2,980 stotype ADF	that cycles the sy 1,234.93 L1Cal. B:Columbia Baseline Cost \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$	stem at design Act. Cost SO SO SO SO	\$0 \$16,494 In speed and verification of the speed and verification	400 h 16,494.4 fies that the 8/Work 32 h 16 h 80 h 2,979.52	0 h hardware gets 13/03 Ovt. Work 0 h 0 h 0 h	\$0 Baseline Work 0 h 0 h 0 h 0 h 0 h 0 h 0 h 0 h	\$2,980 Act. Work 0 h 0 h	400 h 16,494.4 Rem. Work 32 h 16 h 80 h 2,979.52	,	. ,
.2.1.9.2	Notes WBS D Develop M&S B' 400 hor Labor E Based G ID 4 10 13 15 Notes Definiting Test pripart of M&S B' 32 hour	PhysicistU MandS Definition- p special in situ test OE- urs of university eng BOE- on similar software of Prototype inter Resource Name ElecEngU PhysicistU StudentU MandS On- ontotype TAB with signed the effort. OE - rs Columbia engineer	and diagnost sineer at \$412 development to gration test Units 20% 10% 50% 2,979.52 gnals from pro	\$0 \$16,494 ic software to 3.49/w = \$4 for existing L : ADF+TA Cost \$0 \$0 \$2,980 stotype ADF	that cycles the sy 1,234.93 L1Cal. B:Columbia Baseline Cost \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$	stem at design Act. Cost SO SO SO SO	\$0 \$16,494 In speed and verification of the speed and verification	400 h 16,494.4 fies that the 8/Work 32 h 16 h 80 h 2,979.52	0 h hardware gets 13/03 Ovt. Work 0 h 0 h 0 h	\$0 Baseline Work 0 h 0 h 0 h 0 h 0 h 0 h 0 h 0 h	\$2,980 Act. Work 0 h 0 h	400 h 16,494.4 Rem. Work 32 h 16 h 80 h 2,979.52	,	. ,
2.1.9.2	Notes WBS D Develop M&S B 400 hor Labor E Based of ID 4 10 13 15 Notes Definition Test propart of the second of t	PhysicistU MandS Definition- p special in situ test OE- urs of university eng BOE- on similar software of Prototype inter Resource Name ElecEngU PhysicistU StudentU MandS On- ontotype TAB with signed the effort. OE - rs Columbia engineer	and diagnost dineer at \$412 development to the state of t	\$0 \$16,494 ic software to 3.49/w = \$4 for existing L : ADF+TA Cost \$0 \$0 \$2,980 stotype ADF	that cycles the sy 1,234.93 L1Cal. B:Columbia Baseline Cost \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0	So stem at design Act. Cost \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0	\$0 \$16,494 In speed and veri 7/17/03 Rem. Cost \$0 \$0 \$2,980	400 h 16,494.4 fies that the 8/ Work 32 h 16 h 80 h 2,979.52 nnels from tv	hardware gets 13/03 Ovt. Work 0 h 0 h 0 h	\$0 Baseline Work 0 h 0 h 0 h 0 h 0 h 0 h 0 h 0 h 0 h 0	\$2,980 Act. Work 0 h 0 h 0 h 0 h 0 a TAB with no c	400 h 16,494.4 Rem. Work 32 h 16 h 80 h 2,979.52	on. This iten	n represents the Colu

WBS		Name					Start		Finish	M&S EQ	M&S Lab	or FNAL	Labor	Total Cost
1.2.1.9.3		Prototype inte	rototype integration test ADF+TAB:Saclay				7/17/03	8	/13/03	\$0	\$3,29	99	\$0	\$3,299
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	4	ElecEngU	20%	\$0	\$0	\$0	\$0	32 h	0 h	0 h	0 h	32 h		
	10	PhysicistU	10%	\$0	\$0	\$0	\$0	16 h	0 h	0 h	0 h	16 h		
	13	StudentU	50%	\$0	\$0	\$0	\$0	80 h	0 h	0 h	0 h	80 h		
	15	MandS	3,298.88	\$3,299	\$0	\$0	\$3,299	3,298.88		0	0	3,298.88		

Notes

WBS Definition-

Same as above, but for Saclay effort required.

M&S BOE -

32 hours Saclay engineer at \$4122.95/w = \$3,298.36

Labor BOE-

Same as above.

1.2.1.9.4		Prototype integ	gration test	ADF+TA	B+GAB+TFW	: MSL	8/14/03	10	0/9/03	\$0	\$9,62	20 \$	2,496	\$12,116
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	4	ElecEngU	29%	\$0	\$0	\$0	\$0	93 h	0 h	0 h	0 h	93 h		
	7	ElecTechF	20%	\$2,496	\$0	\$0	\$2,496	64 h	0 h	0 h	0 h	64 h		
	10	PhysicistU	30%	\$0	\$0	\$0	\$0	96 h	0 h	0 h	0 h	96 h		
	15	MandS	9,619.84	\$9,620	\$0	\$0	\$9,620	9,619.84		0	0	9,619.84		

Notes
WBS Definition-

Test all prototype elements of L1Cal with timing signals sent from the TFW. Multiple test data events should be sent through the ADF-TAB-GAB chain using timing derived from the SCL. GAB output should be as expected for ADF test input and should be correctly received at the TFW. This item represents the MSU part of the effort.

M&S BOE-

93 h of MSU engineer at \$4123.49/w = \$9,587.11

abor BOE-

Based on the amount of interaction with TFW experts during the STT integration. This effort has been scaled up by approximately a factor of 4 to take into account the more complicated interface between the L1Cal and TFW. 64 h of fermilab technician is used for this task.

1.2.1.9.5		Prototype integ	ration test	ADF+TA	B+GAB+TFW	: Colu	8/14/03	10	0/9/03	\$0	\$5,95	59	\$0	\$5,959
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	4	ElecEngU	20%	\$0	\$0	\$0	\$0	64 h	0 h	0 h	0 h	64 h		
	10	PhysicistU	10%	\$0	\$0	\$0	\$0	32 h	0 h	0 h	0 h	32 h		
	13	StudentU	50%	\$0	\$0	\$0	\$0	160 h	0 h	0 h	0 h	160 h		
	15	MandS	5,959.04	\$5,959	\$0	\$0	\$5,959	5,959.04		0	0	5,959.04		

Notes

WBS Definition-

Same as above, but for Columbia effort required.

M&S BOF -

64 h of Columbia engineer at \$3724.40/w = \$5,959.04

Labor BOE-

Based on experience integrating the STT FRC and TFC. Three periods of integration work of 1 week at Fermilab are assumed separated by 2-week intervals for modifications to the boards/firmware at Nevis and Saclay. Contingency is assigned to take into account the possible need for an extra round of changes to the boards at the universities.

1.2.1.9.6		Prototype integ	gration test	ADF+TA	B+GAB+TFW	: Sacl	8/14/03	1	0/9/03	\$0	\$6,59	98	\$0	\$6,598
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	4	ElecEngU	20%	\$0	\$0	\$0	\$0	64 h	0 h	0 h	0 h	64 h		
	10	PhysicistU	10%	\$0	\$0	\$0	\$0	32 h	0 h	0 h	0 h	32 h		
	13	StudentU	50%	\$0	\$0	\$0	\$0	160 h	0 h	0 h	0 h	160 h		
	15	MandS	6,597.76	\$6,598	\$0	\$0	\$6,598	6,597.76		0	0	6,597.76		

Notes

WBS Definition-

Same as above, but for Saclay effort required.

WBS Start **Finish** M&S EQ M&S Labor **FNAL Labor Total Cost** Name

"Prototype integration test ADF+TAB+GAB+TFW: Saclay" continued

Notes

M&S BOE -

64 h of Saclay engineer at \$4122.95/w = \$6,596.72

Labor BOE-Same as above.

1.2.1.10 **Pre-Production Integration** 4/8/04

5/12/04

\$0 \$12,857 \$4,184

\$17,041

Notes

WBS Definition-

This summary task describes the second stage of a series of tests which combine different boards and eventually the DZero trigger framework (TFW) to ensure that they all work together properly.

Impact on the schedule of mis-estimates of the time required to complete this task is minimized by performing as much of the integration as possible with prototype boards (1.2.1.9).

1.2.1.10.1 \$0 Pre-production integration test ADF+TAB+TFW: MSU 4/8/04 5/5/04 \$4,259 \$2,496 \$6,755

ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
4	ElecEngU	26%	\$0	\$0	\$0	\$0	41 h	0 h	0 h	0 h	41 h
7	ElecTechF	40%	\$2,496	\$0	\$0	\$2,496	64 h	0 h	0 h	0 h	64 h
10	PhysicistU	30%	\$0	\$0	\$0	\$0	48 h	0 h	0 h	0 h	48 h
15	MandS	4,258.88	\$4,259	\$0	\$0	\$4,259	4,258.88		0	0	4,258.88

WBS Definition-

Same as for 1.2.1.9.2, but for first round of production boards.

41 h of MSU engineer at \$4123.49/w = \$4,226.58

Estimated to be half of the prototype integration time. 32 h of fermilab technician included.

1.2.1.10.2 Pre-production integration test ADF+TAB+TFW: Colur. 4/8/04 5/5/04 \$0 \$3,940 \$1.248 \$5,188

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IL)	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work	
	4	ElecEngU	26%	\$0	\$0	\$0	\$0	42 h	0 h	0 h	0 h	42 h	
	7	ElecTechF	20%	\$1,248	\$0	\$0	\$1,248	32 h	0 h	0 h	0 h	32 h	
1	10	PhysicistU	30%	\$0	\$0	\$0	\$0	48 h	0 h	0 h	0 h	48 h	
1	15	MandS	3,939.52	\$3,940	\$0	\$0	\$3,940	3,939.52		0	0	3,939.52	

Notes

WBS Definition-

Same as above, but for Columbia effort

M&S BOE -

42 h of Columbia engineer at \$3724.40/w = \$3,910.62

Estimated to be half of the prototype integration time. Contingency is assigned to take into account the possible need for an extra round of changes to the boards at the universities. 32 h of fermilab technician

included.

1.2.1.10.3		Pre-production	integration	n test AD	F+TAB+TFW:	Sacla	4/8/04		5/5/04	\$0	\$4,25	59	\$0	\$4,259
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	4	ElecEngU	26%	\$0	\$0	\$0	\$0	41 h	0 h	0 h	0 h	41 h		
	10	PhysicistU	30%	\$0	\$0	\$0	\$0	48 h	0 h	0 h	0 h	48 h		
	15	MandS	4,258.88	\$4,259	\$0	\$0	\$4,259	4,258.88		0	0	4,258.88		

WBS Definition-

Same as above, but for Saclay effort

M&S BOE-

WBS M&S EQ **FNAL Labor Total Cost** Start Finish M&S Labor Name "Pre-production integration test ADF+TAB+TFW: Saclay" continued 41 h of Saclay engineer at \$4122.95/w = \$4,226.02 Labor BOE-Same as above. 1.2.1.10.4 Production readiness review 5/6/04 5/12/04 \$0 \$400 \$440 \$840 Resource Name Units Work Ovt. Work Baseline Work Act. Work Rem. Work Cost Baseline Cost Act. Cost Rem. Cost \$440 ElecEngF 20% \$440 0 h 8 h \$0 \$0 8 h 0 h 0 h ElecEngU 10% \$0 \$0 \$0 \$0 4 h 0 h 0 h 0 h 4 h \$0 \$0 \$0 \$0 40 h 10 PhysicistU 100% 0 h 0 h 0 h 40 h 15 MandS 400 \$400 \$0 \$0 \$400 400 0 0 400 Notes WBS Definition-Review to determine readiness of L1Cal system to go into production. M&S BOE-4 h of university engineer at \$100/h = \$400 Labor BOE-8 h of fermilab engineer included. 1.2.1.11 L1 Cal Online Software 1/6/03 1/10/05 \$0 \$0 \$0 \$0 Notes WBS Definition-Develop software for controls, downloading, online diagnostics of L1 Cal system. This includes downloading information from the hardware database, setting up monitoring via the EPICs system, establishing a secondary data acquisition system for recording events without the level 3 system. 1.2.1.11.1 ADF online software 1/6/03 1/10/05 \$0 \$0 \$0 \$0 Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work 10 **PhysicistU** 10% \$0 \$0 400 h 400 h \$0 \$0 0 h 0 h 0 h 14 PostdocU 25% \$0 \$0 \$0 \$0 1.000 h 0 h 0 h 0 h 1.000 h Notes WBS Definition -Write/modify the particular code and data structures that are necessary to operate and monitor the ADF system in the Dzero online environment. This includes downloading information from the hardware database, setting up monitoring via the EPICs system, establishing a secondary data acquisition system for recording events without the level 3 system. Labor BOE-Based on similar tasks for the run2a muon system, which required 50% of a post doc plus 10% of a professor for two years. Since much of the infrastucture is already in place, and similar efforts with the TAB system can be done in conjunction, only 25% of a postdoc is expected to be requires, assuming that another 25% of the same person is spent on TAB online software. 1.2.1.11.2 TAB/GAB online software 1/6/03 1/10/05 \$0 \$0 \$0 \$0 ID Resource Name Units Cost Rem. Cost Work Ovt. Work Act. Work Rem. Work Baseline Cost Act. Cost Baseline Work PhysicistU 400 h 10 10% \$0 \$0 \$0 \$0 400 h 0 h 0 h 0 h \$0 \$0 14 PostdocU 25% \$0 \$0 1,000 h 0 h 0 h 0 h 1,000 h Notes Write/modify the particular code and data structures that are necessary to operate and monitor the TAB/GAB system in the Dzero online environment. This includes downloading information from the hardware database, setting up monitoring via the EPICs system, establishing a secondary data acquisition system for recording events without the level 3 system. Based on similar tasks for the run2a muon system, which required 50% of a post doc plus 10% of a professor for two years. Since much of the infrastucture is already in place, and similar efforts with the ADF system can be done in conjunction, only 25% of a postdoc is expected to be requires, assuming that another 25% of the same person is spent on ADF online software. \$0 1.2.1.12 L1 Calorimeter Trigger Production And Testing Co 2/7/05 2/7/05 \$0 \$0 **\$0**

Milestone: All L1 Cal components produced or procured. Full functionality of custom boards (ADF, TAB, GAB) bench tested at institutes where they were developed. Tests consist of using simulated inputs to

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WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost
L1 Calor	rimeter Trigger Production And Testing Complete" continued						
	Notes verify that all the outputs of the board are as expected and that bit error rates are accommoder of boards required in the system (80 ADFs, 8 TABs and 1 GAB) have passes			ly 1 fatal error per day	at nominal data v	volumes. Milestone is a	achieved when the
.2.2	Level 1 Calorimeter Track Matching	8/1/02	7/14/04	\$177,504	\$40,560	\$30,080	\$248,144
	Notes WBS Definition- This summary element provides for improvements in the Run2a track-matching trigg related cabling, connectors, readout crates, processors, and power supplies.	er. It includes deve	elopment and procure	ment of slightly modif	ed versions of exi	isting Level 1 muon ca	rds, and procureme
.2.2.1	D0 Reviews	1/23/03	6/2/03	\$0	\$400	\$440	\$840
	Notes WBS Definition-						
	milestone: a review by D0 electronics experts (inside and outside of the project) ensi	ures that the design	n is sound and meets	all of the specification	s for operation in	the D0 trigger and data	a acquisition systen
.2.2.1.1	D0 Internal Design Review Complete	1/23/03	1/23/03	\$0	\$0	\$0	\$0
	Notes WBS Definition						
	D0 internal design review with Fermilab, L1CTT, and L1Cal engineers						
.2.2.1.2	D0 Production Readiness Review	5/27/03	6/2/03	\$0	\$400	\$440	\$840
		n. Cost Work		line Work Act. Worl		<u> </u>	
	3 ElecEngF 20% \$440 \$0 \$0 4 ElecEngU 10% \$0 \$0 \$0	\$440 8 h \$0 4 h	0 h 0 h	0 h) h 8 h) h 4 h		
	10 PhysicistU 50% \$0 \$0 \$0 15 MandS 400 \$400 \$0 \$0	\$0 20 h \$400 400	0 h	0 h 0	0 h 20 h 0 400		
	D0 production readiness review before start of MTCxx, MTCM, and MTFB production M&S BOE- 4 h of university engineer at \$100/h = \$400 Labor BOE- 8 h of fermilab engineer included.	n					
.2.2.2	L1 Trigger Cal-Trk Match R&D MOU (UAZ) Complet	11/1/02	11/1/02	\$0	\$0	\$0	\$0
	Notes			•	·	·	
	WBS Definition- milestone: R&D MOU with University of Arizona is signed						
.2.2.3	L1 Trigger Cal-Trk Match Equipment MOU (UAZ) C	12/2/02	12/2/02	\$0	\$0	\$0	\$0
	Notes WBS Definition-						
	milestone: Equipment MOU with University of Arizona is signed.						
.2.2.4	SLDB	12/2/02	9/8/03	\$39,874	\$3,869	\$0	\$43,743
	Notes WBS Definition-						
	This summary task covers the fabrication of the Serial Link Daughter Boards that are	e needed to transm	nit and receive signals	between the L1CTT,	L1Cal, and the L1	Cal-Trk Trigger	
.2.2.4.1	Procure SLDB parts	12/2/02	2/5/03	\$28,771	\$383	\$0	\$29,153
	ID Resource Name Units Cost Baseline Cost Act. Cost	Rem. Cost	Work Ovt. Work			Rem. Work	-
	4 ElecEngU 10% \$0 \$0 15 MandS 29,153.22 \$29,153 \$0 \$0	\$0 \$29,153	32 h (29,153.22	0 h 0 h	0 h 0	32 h 29,153.22	
	Notes WBS Definition						
	MDO DEIMINION						

WBS Name Start Finish M&S EQ M&S Labor FNAL Labor Total Cost

"Procure SLDB parts" continued

Notes

Procure the parts needed for all of the serial link daughter boards

M&S Labor BOE

Same engineer as in run2a will be responsible for procurement and has all records of prices and vendors

M&S labor = 32 hours of EEU = \$382.72

M&S labor pays 20% of EEU salary + ere + overhead, university 80%

M&S Equipment BOE

17*8+1=137 transmitter boards @ \$103.4 = \$14165.8 17*11 = 187 receiver boards @ \$78.1 = \$14604.7

total \$28770.50

unit costs based on actual costs of SLDB parts in run2a * 1.1 (see BOE binder for detailed breakdown).

M&S total = \$29153.22

1.2.2.4.2 Fabricate and assemble SLDBs 2/6/03 7/11/03 \$11,103 \$316 \$0

Resource Name Baseline Cost Rem. Cost Work Ovt. Work Baseline Work Rem. Work Units Cost Act. Cost Act. Work ElecEngU 3% \$0 \$0 \$0 \$0 26.4 h 0 h 0 h 0 h 26.4 h 15 MandS 11,419.14 \$11,419 \$0 \$0 0 0 \$11,419 11,419.14 11,419.14

\$11,419

Notes

WBS Definition

fabricate and assemble the serial link daughter boards that are needed for the cal-track matching system

M&S Labor BOE

Same engineer as in run2a will be responsible for tracking the fabrication and assembly.

M&S labor = 26.4h of an EEU = \$315.74

M&S labor pays only 20% of EEU salary + ere + overhead, university 80%

M&S Equipment BOE-

137 transmitter boards @ \$33 = \$4521

187 receiver boards @ \$35.2 = \$6582.4

Total \$11103.4

unit costs based on actual costs of SLDB fabrication and assemply in run2a (see BOE binder for PO)

M&S total = \$11419.14

1.2.2.4.3 Test SLDBs 7/14/03 9/8/03 \$0 \$3,170 \$0 \$3,170

	Test office					1717/03		3/0/03	ΨΟ	ψυ, 17	O .
ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
4	ElecEngU	20%	\$0	\$0	\$0	\$0	64 h	0 h	0 h	0 h	64 h
8	ElecTechU	60%	\$0	\$0	\$0	\$0	192 h	0 h	0 h	0 h	192 h
10	PhysicistU	20%	\$0	\$0	\$0	\$0	64 h	0 h	0 h	0 h	64 h
15	MandS	3,170.24	\$3,170	\$0	\$0	\$3,170	3,170.24		0	0	3,170.24

Notes

NBS Definition-

Test the serial link daughter boards with stand-alone serial link tester.

M&S Labor BOE-

From run2a, approximately 10 min/board was required for good boards = 55 hours for 324 boards. Additional 200 hours are allowed for debugging and repair of faulty boards.

M&S labor = 64h of EEU and 192h of ETU = \$3170.24

M&S labor pays 20% of EEU salary + ere + overhead, university 80%

M&S labor pays full ETU salary + ere + overhead

VBS		Name					Start	Finis)II	M&S EQ	M&S Labor	FNAL L	abor	Total Cost
est SLD														
	Notes													
		quipment BOE- S equipment												
	M&S to	tal = \$3170.24												
2.2.5		MTCxx					1/23/03	7/14/0)4	\$34,587	\$15,994		\$0	\$50,581
	Notes WBS D	efinition-												
	This su	mmary task describ	es the design,	fabrication,	and testing of th	e MTCxx cards	s which receive	inputs from the le	evel 1 track	king and calorimet	ter systems and d	etermine mato	hes.	
2.2.5.1		(Small) design	changes to	o MTCxx			1/23/03	4/16/0)3	\$0	\$2,296		\$0	\$2,296
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work Ovt	. Work	Baseline Work	Act. Work R	em. Work		
	4 15	ElecEngU MandS	40% 2,296.32	\$0 \$2,296	\$0 \$0	\$0 \$0	\$0 \$2,296	192 h 2,296.32	0 h	0 h 0	0 h 0	192 h 2,296.32		
	Notes WPS D	efinition-												
		existing MTCxx des	ign (which doe	es muon-trac	k matcing in run	2a) for the "no	MTCM mode"	to reduce trigger	latency an	d add 1-2 additior	nal receivers			
	M&S la	stimate based the la bor = 192h of EEU	= \$2296.32	J	ū	en the prototyp	oe and production	on versions of the	Run2a M	TCxx. The same	engineer will be o	loing the desig	n changes	i.
	M&S la	bor pays 20% of EE	I I salary + ere	+ overhead	. university 80%									
			o daidiy . ord	o · overneda	,									
	no M&S	quipment BOE S associated with th tal = \$2296.32	,	o vomodo	, .									
2.2.5.2	no M&S	quipment BOE S associated with th	is task		,,		3/6/03	5/29/0	<u></u>)3	\$22,751	\$574		\$ 0	\$23,325
2.2.5.2	no M&S M&S to	quipment BOE S associated with the stal = \$2296.32 Procure MTC Resource Name	is task	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work	\$0	\$23,325
2.2.5.2	no M&S	quipment BOE 6 associated with th tal = \$2296.32 Procure MTC	is task			\$0	Rem. Cost \$0			Baseline Work	Act. Work	Rem. Work 48 h 23,325.38	\$0	\$23,325
2.2.5.2	no M&S M&S to ID 4 15 Notes	quipment BOE S associated with the stal = \$2296.32 Procure MTC Resource Name ElecEngU MandS	is task xx parts Units 10%	Cost \$0	Baseline Cost	\$0	Rem. Cost \$0	Work 48 h	Ovt. Work	Baseline Work	Act. Work	48 h	\$0 _	\$23,325
2.2.5.2	no M&S M&S to ID 4 15 Notes WBS D	quipment BOE S associated with the stal = \$2296.32 Procure MTC: Resource Name ElecEngU MandS	is task xx parts Units 10% 23,325.38	Cost \$0 \$23,325	Baseline Cost \$0 \$0	\$0 \$0 \$0	Rem. Cost \$0 \$23,325	Work 48 h 23,325.38	Ovt. Work 0 h	Baseline Work	Act. Work	48 h	\$0 _	\$23,325
2.2.5.2	M&S to ID 4 15 Notes WBS D procure	quipment BOE S associated with the stal = \$2296.32 Procure MTC: Resource Name ElecEngU MandS refinition- te the parts to build a	is task xx parts Units 10% 23,325.38	Cost \$0 \$23,325	Baseline Cost \$0 \$0	\$0 \$0 \$0	Rem. Cost \$0 \$23,325	Work 48 h 23,325.38	Ovt. Work 0 h	Baseline Work	Act. Work	48 h	\$0	\$23,325
.2.2.5.2	no M&S to ID 4 15 Notes WBS D procure M&S La Same e M&S la	quipment BOE S associated with the stal = \$2296.32 Procure MTC: Resource Name ElecEngU MandS	is task XX parts Units 10% 23,325.38 II MTCxx card a will be respon \$574.08	Cost \$0 \$23,325 s needed by	Baseline Cost \$0 \$0 the cal-track ma	\$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$	Rem. Cost \$0 \$23,325 , including proto	Work 48 h 23,325.38 types and spares	Ovt. Work 0 h	Baseline Work	Act. Work	48 h	\$0 -	\$23,325
.2.2.5.2	no M&S to ID 4 15 Notes WBS D procure M&S La Same e M&S la M&S la M&S Ed The cos See BO	quipment BOE S associated with the stal = \$2296.32 Procure MTC: Resource Name ElecEngU MandS refinition- te the parts to build a labor BOE- engineer as in run2a labor pays 20% of EE labor pays 20% of EE guipment BOE st is based on parts DE binder for detaile	is task XX parts Units 10% 23,325.38 II MTCxx card a will be respor \$574.08 EU salary + ere cost for the acd itemization of	Cost \$0 \$23,325 s needed by nsible for pro e + overhead	Baseline Cost \$0 \$0 the cal-track ma curement and ha	\$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$	Rem. Cost \$0 \$23,325 , including proto	Work 48 h 23,325.38 types and spares	Ovt. Work 0 h	Baseline Work	Act. Work	48 h	\$0	\$23,325
2.2.5.2	no M&S M&S to ID 4 15 Notes WBS D procure M&S La Same e M&S la M&S la M&S la 13 card	quipment BOE S associated with the stal = \$2296.32 Procure MTC: Resource Name ElecEngU MandS refinition- e the parts to build a sabor BOE- engineer as in run2a bor = 48h of EEU = bor pays 20% of EE quipment BOE st is based on parts DE binder for detaile Is @ \$1750.1 = \$22	is task XX parts Units 10% 23,325.38 II MTCxx card a will be respor \$574.08 EU salary + ere cost for the acd itemization of	Cost \$0 \$23,325 s needed by nsible for pro e + overhead	Baseline Cost \$0 \$0 the cal-track ma curement and ha	so \$0 \$0 \$0 tching system,	Rem. Cost \$0 \$23,325 , including proto	Work 48 h 23,325.38 types and spares	Ovt. Work 0 h	Baseline Work	Act. Work	48 h	\$0 _	\$23,325
	no M&S M&S to ID 4 15 Notes WBS D procure M&S La Same e M&S la M&S la M&S la 13 card	quipment BOE S associated with the stal = \$2296.32 Procure MTC: Resource Name ElecEngU MandS refinition- the parts to build a labor BOE- engineer as in run2a labor BOE et he parts to build a labor BOE et he parts 20% of EE et his based on parts be binder for detaile is @ \$1750.1 = \$22 et al = \$23325.38	is task XX parts Units 10% 23,325.38 II MTCxx card a will be respor \$574.08 EU salary + ere cost for the acd d itemization of	Cost \$0 \$23,325 s needed by nsible for pro e + overhead ctual Run 2a of costs.	Baseline Cost \$(\$0 \$0 \$0 \$1 \$1 \$1 \$1 \$1 \$1 \$1 \$1 \$1 \$1 \$1 \$1 \$1	so \$0 \$0 \$0 tching system,	Rem. Cost \$0 \$23,325 , including proto of prices and ver	Work 48 h 23,325.38 types and spares	Ovt. Work 0 h	Baseline Work	Act. Work h 0 h 0	48 h		
2.2.5.2	no M&S M&S to ID 4 15 Notes WBS D procure M&S La Same e M&S la M&S la M&S Ia M&S Ed The cos See BC 13 card	quipment BOE S associated with the stal = \$2296.32 Procure MTC: Resource Name ElecEngU MandS refinition- te the parts to build a labor BOE- engineer as in run2a labor pays 20% of EE quipment BOE st is based on parts DE binder for detaile is @ \$1750.1 = \$22 stal = \$23325.38 Fabricate and	is task XX parts Units 10% 23,325.38 II MTCxx card: a will be respor \$574.08 :U salary + ere cost for the acd itemization of 751.3 assemble p	Cost \$0 \$23,325 s needed by nsible for pro e + overhead ctual Run 2a of costs.	Baseline Cost \$(\$0 the cal-track main curement and had accurement and had accured to the had accurately accurate	tching system,	Rem. Cost \$0 \$23,325 Including proto of prices and ver 5/30/03	Work 48 h 23,325,38 types and spares ndors. 8/22/0	Ovt. Work 0 h	Baseline Work 0 \$3,718	Act. Work h 0 0 0 0 \$287	48 h 23,325.38	\$0	\$23,325 \$4,005
	no M&S M&S to ID 4 15 Notes WBS D procure M&S La Same e M&S la M&S la M&S la 13 card	quipment BOE S associated with the stal = \$2296.32 Procure MTC: Resource Name ElecEngU MandS refinition- the parts to build a abor BOE- engineer as in run2a bor = 48h of EEU = bor pays 20% of EE quipment BOE st is based on parts DE binder for detaile s @ \$1750.1 = \$22 stal = \$23325.38 Fabricate and Resource Name	is task XX parts Units 10% 23,325.38 II MTCxx card: a will be respor \$574.08 EU salary + ere cost for the acd d itemization of 751.3 assemble p Units	Cost \$0 \$23,325 s needed by nsible for pro e + overhead ctual Run 2a of costs.	Baseline Cost St. St. St. St. St. St. St. S	tching system, as all records o	Rem. Cost \$0 \$23,325 In including proto of prices and ver 5/30/03 Rem. Cost	Work 48 h 23,325.38 types and spares ndors. 8/22/C Work Ovt	Ovt. Work 0 h	\$3,718 Baseline Work	Act. Work h 0 0 0 0 8 \$287 Act. Work R	48 h 23,325.38		
	no M&S to ID 4 15 Notes WBS D procure M&S La Same e M&S la M&S la M&S Ed The cos See BC 13 card M&S to	quipment BOE S associated with the stal = \$2296.32 Procure MTC: Resource Name ElecEngU MandS refinition- te the parts to build a labor BOE- engineer as in run2a labor pays 20% of EE quipment BOE st is based on parts DE binder for detaile is @ \$1750.1 = \$22 stal = \$23325.38 Fabricate and	is task XX parts Units 10% 23,325.38 II MTCxx card: a will be respor \$574.08 :U salary + ere cost for the acd itemization of 751.3 assemble p	Cost \$0 \$23,325 s needed by nsible for pro e + overhead ctual Run 2a of costs.	Baseline Cost \$(\$0 the cal-track main curement and had accurement and had accured to the had accurately accurate	tching system,	Rem. Cost \$0 \$23,325 Including proto of prices and ver 5/30/03	Work 48 h 23,325,38 types and spares ndors. 8/22/0	Ovt. Work 0 h	Baseline Work 0 \$3,718	Act. Work h 0 0 0 0 \$287	48 h 23,325.38		

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WBS Name Start Finish M&S EQ M&S Labor FNAL Labor Total Cost

"Fabricate and assemble prototype MTCxx" continued

Notes

M&S Labor BOE-

Same engineer as in run2a will be responsible for tracking the fabrication and assembly.

M&S labor = 24h = \$287.04

M&S labor pays 20% of EEU salary + ere + overhead, university 80%

M&S Equipment BOE-

2 boards @ \$1859 = \$3718

M&S total = \$4005.04

Unit costs based on small-quantity fabrication. See quotes and PO in BOE binder. Fabrication costs are based on an average of 2 quotes

1.2.2.5.4 Fabrication and Assembly of L1 Trigger Cal-Trk Ma

8/22/03

8/22/03

\$0

\$0

\$0

\$0

Notes

WBS Definition-

milestone: track prototyping status of MTCxx card

1.2.2.5.5 \$0 \$0 8/25/03 10/20/03 \$4,355 \$4,355 Test prototype MTCxx Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work ElecEngU 30% \$0 \$0 \$0 \$0 96 h 0 h 0 h 0 h 96 h ElecTechU 80% \$0 \$0 \$0 \$0 256 h 0 h 0 h 0 h 256 h 8 10 PhysicistU 20% \$0 \$0 \$0 \$0 64 h 0 h 0 h 0 h 64 h 15 MandS 4,354.56 \$4,355 \$0 \$0 \$4,355 4,354.56 0 0 4,354.56

Notes

WBS Definition

Test functionality of prototype MTCxx card on existing Level-1 muon test stand.

M&S Labor BOE-

Based on the time required to test the pre-production MTCxx card in run 2a

M&S labor = 96h of EEU and 256h of ETU = \$4354.56

M&S labor pays 20% of EEU salary + ere + overhead, university 80%

M&S labor pays full ETU salary + ere + overhead

M&S Equipment BOE-

n/a

M&S total = \$4354.56

1.2.2.5.6		Final design c	hanges to N	ИТСхх			10/21/03	1	2/3/03	\$0	\$1,14	18	\$0	\$1,148
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	4	ElecEngU	40%	\$0	\$0	\$0	\$0	96 h	0 h	0 h	0 h	96 h		
	15	MandS	1 148 16	\$1 148	\$0	\$0	\$1 148	1 148 16		0	0	1 148 16		

Notes

WBS Definition-

Update MTCxx design for problems identified in the prototype testing

M&S Labor BOE-

Time estimate based the labor required for the design changes between the prototype and production versions of the Run2a MTCxx, scaled down to one third. The same engineer will be doing the design changes M&S labor = 96h of EEU = \$1148.16

M&S labor pays 20% of EEU salary + ere + overhead, university 80%

M&S Equipment BOE-

No M&S equipment associated with this task

M&S total = \$1148.16

VBS														
		Name		ATO			Start		Finish	M&S EQ	M&S Labor	FNAL		Total Cost
2.2.5.7	ID	Fabricate and a	Units	Cost	Baseline Cost	Act. Cost	12/4/03 Rem. Cost	Work	4/5/04 Ovt. Work	\$8,118 Baseline Work	\$383 Act. Work R	em. Work	\$0	\$8,501
	4	ElecEngU	5%	\$0	\$0	\$0	\$0	32 h	0 h	0 h	0 h	32 h		
	15	MandS	8,500.72	\$8,501	\$0	\$0	\$8,501	8,500.72		0	0	8,500.72		
		efinition- te 11 MTCxx boards,	, including 2 s	pares.										
	Same e M&S la	abor BOE- engineer as in run2a v bor = 32h of EEU = \$ bor pays 20% of EEU	382.72		· ·	ion and assei	mbly.							
		quipment BOE s @ \$738 = \$8118												
	Unit co	sts based on actual c	osts of MTCx	x fabrication	on and assemply i	n run2a. See	quotes and PO's	s in BOE bi	nder. Fabricat	ion costs are base	d on an average o	of 2 quotes		
	M&S to	tal = \$8500.72												
2.2.5.8		Fabrication an	d Assemb	ly of L1	Trigger Cal-1	rk Ma	4/5/04		4/5/04	\$0	\$0		\$0	\$0
	Notes				00									
		efinition- ne: to track productio	n status of M	TCxx cards	3									
2.2.5.9		Test MTCxx's					4/6/04	7	/14/04	\$0	\$6,951		\$0	\$6,951
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work		em. Work		
	<i>4</i> 8	ElecEngU ElecTechU	20% 80%	\$0 \$0	\$0 \$0	\$0 \$0	\$0 \$0	112 h 448 h	0 h 0 h	0 h 0 h	0 h 0 h	112 h 448 h		
	9 15	PhysicistF MandS	20% 6,950.72	\$0 \$6,951	\$0 \$0	\$0 \$0	\$0 \$6,951	112 h 6,950.72	0 h	0 h 0	0 h 0	112 h 6,950.72		
	Notes		.,	, ,, ,			, ,,,,,,	-,				.,		
		efinition-		avald move	on took atond									
				ever i muc										
	Test fu	nctionality of MTCxx of	carus on the t	2010.1	on test stand.									
	Test fur M&S La	abor BOE-				d auick fives	nlus 8 weeks (na	art time) for	fixing more co	nmoley problems				
	Test fur M&S La Based M&S la	abor BOE- on Run2a MTCxx rat bor = 112h of EEU ar	te of 2 days/b nd 448h of ET	oard (full ti	me) for testing an 0.72	•	plus 8 weeks (pa	art time) for	fixing more co	omplex problems.				
	M&S La Based M&S la M&S la	abor BOE- on Run2a MTCxx rat	te of 2 days/b nd 448h of E1 f EEU salary -	oard (full ti U = \$6950 ere + ove	me) for testing an 0.72	•	plus 8 weeks (pa	art time) for	fixing more co	omplex problems.				
	M&S La Based M&S la M&S la M&S la M&S la	abor BOE- on Run2a MTCxx rat bor = 112h of EEU ar bor pays only 20% of bor pays full ETU sal- quipment BOE-	te of 2 days/b nd 448h of ET f EEU salary - ary + ere + o\	oard (full ti TU = \$6950 + ere + ove /erhead	me) for testing an 0.72 Irhead, university	•	plus 8 weeks (pa	art time) for	fixing more co	mplex problems.				
	M&S La Based M&S la M&S la M&S la M&S En There a	abor BOE- on Run2a MTCxx rat bor = 112h of EEU ar bor pays only 20% of bor pays full ETU sal	te of 2 days/b nd 448h of ET f EEU salary - ary + ere + o\	oard (full ti TU = \$6950 + ere + ove /erhead	me) for testing an 0.72 Irhead, university	•	plus 8 weeks (pa	art time) for	fixing more co	omplex problems.				
2.2.6	M&S La Based M&S la M&S la M&S la M&S En There a	abor BOE- on Run2a MTCxx rat bor = 112h of EEU ar bor pays only 20% of bor pays full ETU sal quipment BOE- ire no M&S equipmer tal = \$6950.72	te of 2 days/b nd 448h of ET f EEU salary - ary + ere + o\	oard (full ti TU = \$6950 + ere + ove /erhead	me) for testing an 0.72 Irhead, university	•		,			\$3.732		\$0	\$16.008
.2.2.6	M&S La Based M&S la M&S la M&S la M&S En There a	abor BOE- on Run2a MTCxx rat bor = 112h of EEU ar bor pays only 20% of bor pays full ETU sal quipment BOE- ire no M&S equipmer	te of 2 days/b nd 448h of ET f EEU salary - ary + ere + o\	oard (full ti TU = \$6950 + ere + ove /erhead	me) for testing an 0.72 Irhead, university	•	plus 8 weeks (pa	,	fixing more co	smplex problems.	\$3,732		\$0	\$16,008
2.2.6	Test fun M&S La Based M&S la M&S la M&S E There a M&S to	abor BOE- on Run2a MTCxx rat bor = 112h of EEU at bor pays only 20% of bor pays full ETU sal quipment BOE- tre no M&S equipmer tal = \$6950.72 MTCM efinition- mmary task describe	te of 2 days/b nd 448h of ET EEU salary - ary + ere + ov nt costs assoc	oard (full ti TU = \$6950 Fere + ove verhead	me) for testing an 0.72 brhead, university this task		3/20/03	1	/26/04	\$12,276		card is alrea	•	, ,
2.2.6	Test fun M&S La Based i M&S la M&S la M&S la M&S E There a M&S to Notes WBS D This su	abor BOE- on Run2a MTCxx rat bor = 112h of EEU at bor pays only 20% of bor pays full ETU sal quipment BOE- tre no M&S equipmer tal = \$6950.72 MTCM efinition- mmary task describe	te of 2 days/b nd 448h of ET FEEU salary - ary + ere + ov nt costs associ	oard (full ti TU = \$6950 + ere + ove verhead Siated with	me) for testing an 0.72 brhead, university this task		3/20/03	1 r. One mar	/26/04	\$12,276		card is alrea	•	, ,

15 Notes

Notes WBS Definition-

ElecEngU MandS

Modify existing MTCM design to fix known minor problems.

30%

1,148.16

\$0 \$1,148

\$0

\$1,148

72 h

1,148.16

\$0 \$0

\$0 \$0 72 h 1,148.16

WBS Start Finish M&S EQ M&S Labor **FNAL Labor Total Cost** Name "(Small) design changes to MTCM" continued M&S Labor BOE-Engineer who designed run2a MTCM will be making modifications. M&S labor = 96h of EEU = \$1148.16 M&S labor pays 20% of EEU salary + ere + overhead, university 80% M&S Equipment BOE-There is no M&Sequipment associated with this task. M&S total = \$1148.16 1.2.2.6.2 Procure MTCM parts 5/1/03 7/25/03 \$8.052 \$574 \$0 \$8.626 Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work ElecEngU 10% \$0 \$0 \$0 \$0 48 h 0 h 0 h 0 h 48 h 15 MandS \$0 8,626.08 \$8,626 \$0 \$8,626 8,626.08 0 0 8,626.08 Notes WBS Definition-Procure the parts to build all MTCM cards needed by the cal-track matching system, including spares. M&S Labor BOE-Same engineer as in run2a will be responsible for procurement and has all records of prices and vendors. M&S labor = 48h of EEU = \$574.08 M&S labor pays 20% of EEU salary + ere + overhead, university 80% M&S Equipment BOE-The cost is based on parts cost for the Run 2a MTCM's x 1.1 3 cards @ \$2684 = \$8052 See BOE binder for detailed itemization of costs. M&S total = \$8626.08 1.2.2.6.3 Fabricate and assemble MTCMs 7/28/03 10/20/03 \$4,224 \$287 \$0 \$4,511 Baseline Work Ovt. Work Rem. Work Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Act. Work 4 ElecEngU 5% \$0 \$0 \$0 \$0 24 h 0 h 0 h 0 h 24 h 4,511.04 4,511.04 15 MandS \$4,511 \$0 \$0 \$4,511 0 0 4,511.04 Notes WBS Definition-Fabricate and assmble 3 MTCM cards, including 2 spares. Same engineer as in run2a will be responsible for tracking the fabrication and assembly. M&S labor = 24h of EEU = \$287.04 M&S labor pays 20% of EEU salary + ere + overhead, university 80% M&S Equipment BOE-3 cards @ \$1408 = \$4224 Unit costs based on actual costs of MTCxx fabrication and assemply in run2a x 1.1. See BOE binder for PO's. M&S total = \$4511.04 1.2.2.6.4 Fabrication and Assembly of L1 Trigger Cal-Trk Ma 10/20/03 10/20/03 \$0 \$0 \$0 \$0 Notes WBS Definition milestone:

1.2.2.6.5		Name					Start	Fir	nish	M&S EQ	M&S Labor	FNAL	Labor	Total Cost
		Test MTCMs					10/21/03	1/26	6/04	\$0	\$1,722	2	\$0	\$1,722
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost		Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	4 15	ElecEngU MandS	30% 1,722.24	\$0 \$1,722	\$0 \$0	\$0 \$0	\$0 \$1,722	144 h 1,722.24	0 h	0 h 0	0 h 0	144 h 1,722.24		
		Marius	1,722.24	\$1,122	\$0	\$0	\$1,722	1,122.24		U	U	1,722.24		
;	Notes	efinition-												
		nctionality of MTCM	cards on the	existing Le	vel1 muon test sta	and.								
	Based of M&S lal	abor BOE- on Run2a MTCM te bor = 144h of EEU = bor pays 20% of EE	= \$1722.24											
		quipment BOE- S equipment on this	task											
İ	M&S to	tal = \$1722.24												
.2.2.7	.,,	MT Flavor Bo	ard				8/1/02	11/3	3/03	\$20,709	\$11,805	;	\$0	\$32,514
;	Notes WBS D	efinition-												
		mmary task describ	es the design.	, productior	, and testing of th	e "muon trigg	er flavor board" v	which mounts o	on the MTC	xx and does the ad	ctual matching a	lgorithm.		
2.2.7.1		Design prototy	pe cal-trk a	algorithm			8/1/02	12/23	3/02	\$0	\$0)	\$0	\$0
	ID	Resource Name	•	J	seline Cost Ac	t. Cost Rei	m. Cost Work			ne Work Act. W			40	40
	10	PhysicistU	25%	\$0	\$0	\$0	\$0 200) h	0 h		30 h		
	Notes													
;		efinition -												
		o and simulate a pro	ototype algorit	hm to matc	h tracks with calo	rimeter cluste	rs in the cal-trk m	natch FPGA's						
		•	,, 0											
	Labor B													
	Modifica	ation of existing Lev	el 1 muon alg	orithms with	h match tracks wi	th muon hits.	I ime estimate ba	ased on run2a	experience	optimizing existing	algorithms			
		Daa:					10/17/00	2/10	9/03	\$0	MO 00		ው	
.2.2.7.2		Design prototy	pe MTFB				10/17/02	2/13		4.0	\$6,304	+	\$0	\$6,304
.2.2.7.2	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work (Ovt. Work	Baseline Work	Act. Work	Rem. Work	φU	\$6,304
.2.2.7.2	4	Resource Name ElecEngU	Units 30%	\$0	\$0	\$0	Rem. Cost \$0	Work (0 h	Baseline Work 0 h	Act. Work	Rem. Work 192 h	Φ0	\$6,304
2.2.7.2	4 8	Resource Name ElecEngU ElecTechU	Units 30% 50%	\$0 \$0	\$0 \$0	\$0 \$0	Rem. Cost \$0 \$0	Work C 192 h 320 h	0 h 0 h	Baseline Work 0 h 0 h	Act. Work 0 h 0 h	Rem. Work 192 h 320 h	Ф О	\$6,304
.2.2.7.2	4	Resource Name ElecEngU	Units 30%	\$0	\$0	\$0	Rem. Cost \$0	Work (0 h	Baseline Work 0 h	Act. Work	Rem. Work 192 h	\$ О	\$6,304
.2.2.7.2	4 8 10 15	Resource Name ElecEngU ElecTechU PhysicistU	Units 30% 50% 20%	\$0 \$0 \$0	\$0 \$0 \$0	\$0 \$0 \$0	Rem. Cost \$0 \$0 \$0	Work 0 192 h 320 h 128 h	0 h 0 h	Baseline Work 0 h 0 h 0 h	Act. Work 0 h 0 h 0 h	Rem. Work 192 h 320 h 128 h	\$ О	\$6,304
	4 8 10 15 Notes	Resource Name ElecEngU ElecTechU PhysicistU	Units 30% 50% 20%	\$0 \$0 \$0	\$0 \$0 \$0	\$0 \$0 \$0	Rem. Cost \$0 \$0 \$0	Work 0 192 h 320 h 128 h	0 h 0 h	Baseline Work 0 h 0 h 0 h	Act. Work 0 h 0 h 0 h	Rem. Work 192 h 320 h 128 h	.	\$6,304
	4 8 10 15 Notes WBS D	Resource Name ElecEngU ElecTechU PhysicistU MandS	Units 30% 50% 20% 6,304.32	\$0 \$0 \$0 \$6,304	\$0 \$0 \$0 \$0	\$0 \$0 \$0 \$0	Rem. Cost \$0 \$0 \$0 \$0 \$6,304	Work 0 192 h 320 h 128 h 6,304.32	0 h 0 h 0 h	Baseline Work 0 h 0 h 0 h 0 h	Act. Work 0 h 0 h 0 h 0 h	Rem. Work 192 h 320 h 128 h 6,304.32		\$6,304
;	4 8 10 15 Notes WBS D Modify (Resource Name ElecEngU ElecTechU PhysicistU MandS efinition- existing Run2a flavo	Units 30% 50% 20% 6,304.32	\$0 \$0 \$0 \$6,304	\$0 \$0 \$0 \$0	\$0 \$0 \$0 \$0	Rem. Cost \$0 \$0 \$0 \$0 \$6,304	Work 0 192 h 320 h 128 h 6,304.32	0 h 0 h 0 h	Baseline Work 0 h 0 h 0 h 0 h	Act. Work 0 h 0 h 0 h 0 h	Rem. Work 192 h 320 h 128 h 6,304.32		\$6,304
- ; !	4 8 10 15 Notes WBS D Modify (Resource Name ElecEngU ElecTechU PhysicistU MandS efinition- existing Run2a flavo	Units 30% 50% 20% 6,304.32 or board desig	\$0 \$0 \$0 \$6,304 gn to use mo	\$0 \$0 \$0 \$0 \$0 pore powerful FPG	\$0 \$0 \$0 \$0	Rem. Cost \$0 \$0 \$0 \$0 \$0 \$0 \$6,304	Work (192 h 320 h 128 h 6,304.32	0 h 0 h 0 h	Baseline Work 0 h 0 h 0 h 0 o 0 h 1 o	Act. Work 0 h 0 h 0 h 0 h 0 constant of the second of the	Rem. Work 192 h 320 h 128 h 6,304.32 velopment and	d simulation	
; ;	4 8 10 15 Notes WBS D Modify of M&S La EEU wh The tim	Resource Name ElecEngU ElecTechU PhysicistU MandS efinition- existing Run2a flavo	Units 30% 50% 20% 6,304.32 or board desig muon trigger fla	\$0 \$0 \$0 \$6,304 gn to use mo	\$0 \$0 \$0 \$0 ore powerful FPG will be doing the two months at ha	\$0 \$0 \$0 \$0 A's and provic design and la lif time for des	Rem. Cost \$0 \$0 \$0 \$0 \$0 \$6,304 de serial link outp	Work (192 h 320 h 128 h 6,304.32 but. Work inclu	0 h 0 h 0 h des schema	Baseline Work 0 h 0 h 0 h 0 h atic, layout, and FF	Act. Work 0 h 0 h 0 h 0 h 0 constant of the second of a serial link	Rem. Work 192 h 320 h 128 h 6,304.32 velopment an	d simulation the FPGA de lengthen the	esign and simulatic time. However we
· ·	4 8 10 15 WBS D Modify of M&S La EEU wh The tim also alro	Resource Name ElecEngU ElecTechU PhysicistU MandS efinition- existing Run2a flavo abor BOE- no designed run2a re e is based on the rue eady completed so	Units 30% 50% 20% 6,304.32 or board desig muon trigger fla	\$0 \$0 \$0 \$6,304 gn to use mo	\$0 \$0 \$0 \$0 ore powerful FPG will be doing the two months at ha	\$0 \$0 \$0 \$0 A's and provic design and la lif time for des	Rem. Cost \$0 \$0 \$0 \$0 \$0 \$6,304 de serial link outp	Work (192 h 320 h 128 h 6,304.32 but. Work inclu	0 h 0 h 0 h des schema	Baseline Work 0 h 0 h 0 h 0 h atic, layout, and FF	Act. Work 0 h 0 h 0 h 0 h 0 constant of the second of a serial link	Rem. Work 192 h 320 h 128 h 6,304.32 velopment an	d simulation the FPGA de lengthen the	esign and simulatic time. However we
; ;	4 8 10 15 Notes WBS D Modify of M&S La EEU wh The tim also alro	Resource Name ElecEngU ElecTechU PhysicistU MandS efinition- existing Run2a flavo abor BOE- no designed run2a n e is based on the ru eady completed sol	Units 30% 50% 20% 6,304.32 or board designmuon trigger flance experience me groundword me groundword me groundword me groundword some groundw	\$0 \$0 \$0 \$6,304 gn to use mo lavor board ce of about rk on the de	\$0 \$0 \$0 \$0 pre powerful FPG will be doing the two months at has asign of the board	\$0 \$0 \$0 \$0 A's and provic design and la lif time for des	Rem. Cost \$0 \$0 \$0 \$0 \$0 \$6,304 de serial link outp	Work (192 h 320 h 128 h 6,304.32 but. Work inclu	0 h 0 h 0 h des schema	Baseline Work 0 h 0 h 0 h 0 h atic, layout, and FF	Act. Work 0 h 0 h 0 h 0 h 0 constant of the second of a serial link	Rem. Work 192 h 320 h 128 h 6,304.32 velopment an	d simulation the FPGA de lengthen the	esign and simulatic time. However we
; ;	4 8 10 15 Modify of M&S La EEU wh The tim also alro M&S La M&S La	Resource Name ElecEngU ElecTechU PhysicistU MandS efinition- existing Run2a flavo abor BOE- no designed run2a re e is based on the rue eady completed so	Units 30% 50% 20% 6,304.32 or board desig muon trigger flanda experience me groundwor and 320h of E	\$0 \$0 \$0 \$6,304 gn to use mo lavor board ce of about rrk on the de	\$0 \$0 \$0 \$0 \$0 pore powerful FPG will be doing the two months at ha esign of the board	\$0 \$0 \$0 \$0 \$0 A's and provic design and la lif time for des itself which w	Rem. Cost \$0 \$0 \$0 \$0 \$0 \$6,304 de serial link outp	Work (192 h 320 h 128 h 6,304.32 but. Work inclu	0 h 0 h 0 h des schema	Baseline Work 0 h 0 h 0 h 0 h atic, layout, and FF	Act. Work 0 h 0 h 0 h 0 h 0 constant of the second of a serial link	Rem. Work 192 h 320 h 128 h 6,304.32 velopment an	d simulation the FPGA de lengthen the	esign and simulatic time. However we
 	4 8 10 15 WBS D Modify of M&S La EEU wh The tim also alro M&S La M&S lal M&S lal	Resource Name ElecEngU ElecTechU PhysicistU MandS efinition- existing Run2a flavo abor BOE- no designed run2a n e is based on the ru eady completed sol abor BOE- bor = 192h of EEU a	Units 30% 50% 20% 6,304.32 or board desig muon trigger fl. un2a experience me groundwork and 320h of E'EU salary + ere	\$0 \$0 \$6,304 gn to use mo lavor board ce of about rk on the de	\$0 \$0 \$0 \$0 \$0 pore powerful FPG will be doing the two months at ha esign of the board	\$0 \$0 \$0 \$0 \$0 A's and provic design and la lif time for des itself which w	Rem. Cost \$0 \$0 \$0 \$0 \$0 \$6,304 de serial link outp	Work (192 h 320 h 128 h 6,304.32 but. Work inclu	0 h 0 h 0 h des schema	Baseline Work 0 h 0 h 0 h 0 h atic, layout, and FF	Act. Work 0 h 0 h 0 h 0 h 0 constant of the second of a serial link	Rem. Work 192 h 320 h 128 h 6,304.32 velopment an	d simulation the FPGA de lengthen the	esign and simulatic time. However we

M&S total = \$6304.32

WBS		Name					Start		Finish	M&S EQ	M&S Lab	or FNAL	Labor	Total Cost
1.2.2.7.3		Procure protot	ype MTFB	parts			2/20/03	3	/19/03	\$1,540	\$9	96	\$0	\$1,636
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	4	ElecEngU	5%	\$0	\$0	\$0	\$0	8 h	0 h	0 h	0 h	8 h	•	
	15	MandS	1,635.68	\$1,636	\$0	\$0	\$1,636	1,635.68		0	0	1,635.68		
	Notes	:												

WBS Definition-

Procure the parts needed for flavor board prototypes

M&S Labor BOE-

Same engineer as in run2a will be responsible for procurement and has all records of prices and vendors.

M&S labor = 8h of EEU = \$95.68

M&S labor pays 20% of EEU salary + ere + overhead, university 80%

M&S Equipment BOE-

See BOE binder for cost based on parts. Cost based on Run2a MTFB boards but with new FPGA; 2 boards @ \$770 = \$1540

M&S total = \$1635.68

1.2.2.7.4		Fabricate and	assemble p	orototype	MTFB		3/20/03	5	/14/03	\$4,440	\$19	91	\$0	\$4,631
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	4	ElecEngU	5%	\$0	\$0	\$0	\$0	16 h	0 h	0 h	0 h	16 h	<u>-</u> '	
	15	MandS	4.631.36	\$4.631	\$0	\$0	\$4.631	4.631.36		0	0	4.631.36		

Notes

WBS Definition-

Fabricate and assemble two prototype MTFB flavor boards

M&S Labor BOE-

Same engineer as in run2a will be responsible for tracking the fabrication and assembly.

M&S labor = 16h of EEU = 191.36\$

M&S labor pays 20% of EEU salary + ere + overhead, university 80%

M&S Equipment BOE-

2 boards at \$2220 = \$4440

Unit costs based on actual costs of MTFB assembly * 1.1. Assembly costs were \$72/board plus NRE charges. Fabrication costs are the average of 2 quotes. See BOE binder for run2a po and quotes.

M&S total = \$4631.36

1.2.2.7.5	Fabrication and Assembly of L1 Trigger Cal-Trk Ma	5/14/03	5/14/03	\$0	\$0	\$0	\$0
	Notes WBS Definition- milestone; to track prototyping status of MTFB						

1.2.2.7.6		Test prototype	MTFB				5/15/03	6	/12/03	\$0	\$1,98	36	\$0	\$1,986
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	4	ElecEngU	20%	\$0	\$0	\$0	\$0	32 h	0 h	0 h	0 h	32 h		
	8	ElecTechU	80%	\$0	\$0	\$0	\$0	128 h	0 h	0 h	0 h	128 h		
	10	PhysicistU	20%	\$0	\$0	\$0	\$0	32 h	0 h	0 h	0 h	32 h		
	15	MandS	1,985.92	\$1,986	\$0	\$0	\$1,986	1,985.92		0	0	1,985.92		

WBS Definition-

Test functionality of prototype MTFB on existing Level-1 muon test stand.

M&S Labor BOE-

Based on the time required to test the production MTFB cards in run 2a of one board per day (full-time) plus additional time for testing new downloading, boundary scan testing, and serial link features.

M&S labor = 32h of EEU and 128h of ETU= \$1985.92

M&S labor pays 20% of EEU salary + ere + overhead, university 80%

M&S labor pays full ETU salary + ere + overhead

M&S Equipment BOE

WBS M&S EQ M&S Labor **FNAL Labor** Name Start Finish **Total Cost** "Test prototype MTFB" continued There is no M&S equipment associated with this task M&S total = \$1985.92 1.2.2.7.7 Procure MTFB parts 6/13/03 7/11/03 \$8,470 \$153 \$0 \$8,623 Baseline Work Rem. Work Resource Name Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Act. Work ElecEngU 4% \$0 \$0 \$0 \$0 6.4 h 0 h 0 h 6.4 h 15 MandS 8,623.09 \$8,623 \$0 \$0 \$8,623 8,623.09 8,623.09 Notes WBS Definition-Procure the parts to build all MTFB cards needed by the cal-track matching system, including spares. M&S Labor BOE-Same engineer as in run2a will be responsible for procurement and has all records of prices and vendors. M&S labor = 12.8h of EEU = \$153.09 M&S labor pays 20% of EEU salary + ere + overhead, university 80% M&S Equipment BOE-See BOE binder for detailed itemization of costs. Based on run2a MTFB costs plus a new FPGA 11 boards @ \$770 = \$8470 M&S total = \$8623.09 1.2.2.7.8 Fabricate and assemble MTFB 7/14/03 9/8/03 \$6,259 \$287 \$0 \$6,546 ID Resource Name Rem. Cost Ovt. Work Baseline Work Rem. Work Units Cost Baseline Cost Act. Cost Work Act. Work ElecEngU 4 16 h 16 h 5% \$0 \$0 \$0 \$0 0 h 0 h 0 h 15 MandS 6,546.04 \$6,546 \$0 \$0 \$6,546 6,546.04 0 0 6,546.04 Notes WBS Definition-Fabricate 11 MTFB cards, including 2 spares M&S Labor BOE-Same engineer as in run2a will be responsible for tracking the fabrication and assembly. M&S labor = 24h of EEU = \$287.04 M&S labor pays 20% of EEU salary + ere + overhead, university 80% M&S Equipment BOE-11 boards @ \$569 = \$6259 Unit costs based on actual costs of MTFB assembly * 1.1. Assembly costs were \$72/board plus NRE charges. Fabrication costs are the average of 2 quotes. See BOE binder for run2a po and quotes M&S total = \$6485.54 1.2.2.7.9 Fabrication and Assembly of L1 Trigger Cal-Trk Ma 9/8/03 9/8/03 \$0 \$0 \$0 \$0 Notes WBS Definitionmilestone: to track production status of MTFB's 1.2.2.7.10 Test MTFB 9/9/03 11/3/03 \$0 \$2,788 \$0 \$2,788 Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work 4 ElecEngU 10% \$0 \$0 \$0 \$0 32 h 0 h 0 h 0 h 32 h **ElecTechU** 60% \$0 \$0 192 h 192 h \$0 \$0 0 h 0 h 0 h 10 PhysicistU 20% \$0 \$0 \$0 \$0 64 h 0 h 0 h 0 h 64 h 15 MandS 2.787.52 \$2,788 \$0 \$0 \$2,788 2.787.52 0 0 2.787.52 Notes

WBS Definition

Test functionality of MTFB cards on the Level1 muon test stand.

WBS Name Start Finish M&S EQ M&S Labor FNAL Labor Total Cost

"Test MTFB" continued

Notes

M&S Labor BOE-

Based on Run2a MTFB rate of 1 board/day (full time) plus additional time for trouble-shooting

M&S labor = 32h of EEU and 192h of ETU = \$2787.52

M&S labor pays 20% of EEU salary + ere + overhead, university 80%

M&S labor pays full ETU salary + ere + overhead

M&S Equipment BOE-

There are no M&S equipment costs associated with this task

M&S total = \$2787.52

1.2.2.8 Infrastructure 12/2/02 2/9/04 \$70,058 \$4,761 \$29,640 \$104,459

Notes

WBS Definition-

This summary element includes various infrastructure components such as cabling, crates, backplanes and power supplies.

\$0

\$0

1.2.2.8.1 3/20/03 7/11/03 \$16.410 \$230 \$0 \$16.639 Procure cables and connectors ID Resource Name Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work ElecEngU 3% \$0 \$0 \$0 \$0 19.2 h 0 h 0 h 0 h 19.2 h

\$16,639

15 Notes

WBS Definition-

MandS

Procure the cables and connectors needed by the cal-track matching system including spares.

\$16,639

M&S Labor BOE-

Approximately 3 days of work to re-order cables and connectors that were used in the run2a Level 1 muon trigger.

M&S labor = 19.2h of EEU = \$229.63

M&S labor pays 20% of EEU salary + ere + overhead, university 80%

16,639.36

M&S Equipment BOE-

Run 2a costs x 1.1. See BOE binder for Run 2a PO's. See xls spreadsheet for connector details Costs are connector for one end plus connector for the other end plus 1/8 connector shell costs are for cables from the "front ends" to the splitter cards (bnc to sma) and from the splitter cards to the mtcxx cards (conec to conec) and on board the mtcxx cards (conec to mcx).

16,639.36

0

0

16,639.36

M&S Equipment total = \$16409.63

M&S total = \$16639.36

1.2.2.8.2 7/14/03 10/6/03 \$0 \$601 \$9.360 \$9.961 Assemble cables ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work ElecTechF 50% \$9,360 \$0 \$0 \$9,360 240 h 0 h 0 h 0 h 240 h 20% \$0 \$0 96 h 96 h ElecTechU \$0 \$0 0 h 0 h 0 h 8 10 **PhysicistU** 25% \$0 \$0 \$0 \$0 120 h 0 h 0 h 0 h 120 h MandS 601.2 \$601 \$0 \$0 601.2 601.2 15 \$601 Λ 0

Notes

WBS Definition

Assemble cables at Fermilab and a smaller number at arizona eq the first couple sets would be done at arizona to determine length and test procedure.

Labor BOE

Based on Run 2a experience of 2 complete cables per hour (cutting, termination, testing, rework, lableling).

M&S labor = 48h of ETU = \$601.20

M&S labor pays full ETU salary + ere + overhead

M&S total = \$601.20

1.2.2.8.3 Procure VME crates 12/2/02 6/12/03 \$8.600 \$373 \$0 \$8,973 Resource Name Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work ElecTechU \$0 31.2 h 0 h 31.2 h \$0 \$0 \$0 0 h 0 h 15 MandS 8,973.15 \$8,973 \$0 \$0 \$8,973 8,973.15 0 0 8,973.15

WBS Start Finish M&S EQ M&S Labor **FNAL Labor Total Cost** Name

"Procure VME crates" continued

WBS Definition-

Procure two custom VME crates for MTCxx cards for cal-trk match.

M&S Labor BOE

Mostly waiting for order to be filled; about 3/4 of a week total interacting with vendor. The crate is special-ordered by Tre New through Electronic Solutions.

\$0

M&S labor = 31.2h of EEU = \$373.15

M&S labor pays 20% of EEU salary + ere + overhead, university 80%

M&S Equipment BOE-

See BOE binder for vendor quote

M&S equipment total = 2 x \$4300 = \$8600

M&S total = \$8973.15

1.2.2.8.4		Procure VME p	processors				3/20/03	9.	/22/03	\$8,368	\$12	24	\$0	\$8,492
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	4	ElecEngU	1%	\$0	\$0	\$0	\$0	10.4 h	0 h	0 h	0 h	10.4 h		

8.492.38

8.492.38

\$8.492

MandS Notes

WBS Definition-

15

Procure 3 6u embedded processors and form factor adapters for control and downloading of the MTCxx crates.

\$0

\$8.492

M&S Labor BOE-

One day to place order and follow up.

M&S labor = 10.4h of EEU = \$124.38

M&S labor pays 20% of EEU salary + ere + overhead, university 80%

8.492.38

M&S Equipment BOE-

See BOE binder for vendor quote = 2 processors @ 3655 = 7310

Form adaptors are 2 x \$529 = \$1058 from run 2a experience

M&S equipment total = \$8368

M&S total = \$8434.38

1.2.2.8.5		Procure power	supplies				1/23/03	7/25	5/03	\$13,565	\$124		\$0	\$13,690
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	4	ElecEngU	1%	\$0	\$0	\$0	\$0	10.4 h	0 h	0 h	0 h	10.4 h	_	
	15	MandS	13 680 58	¢13 600	90	90	\$13,600	13 680 58		0	0	13 680 58		

Notes

WBS Definition-

Procure power supplies for MTCxx crate.

M&S Labor BOE-

Mostly waiting for order to be filled; about one day of getting quotes, placing order,

and follow-up

M&S labor = 10.4h of EEU = \$124.38

M&S labor pays 20% of EEU salary + ere + overhead, university 80%

M&S Equipment BOE-

Vendor quote x 1.1 (see BOE binder)

Price is for 4 supplies including 2 spares @\$3391.3

They are packaged as 2 x 2 supplies each = \$13565.2

M&S total = \$13689.58

1.2.2.8.6		Assemble and	test power	supplies			7/28/03	2	2/9/04	\$4,180	\$12	4 \$20,280	\$24,584
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work	
	4	ElecEngU	1%	\$0	\$0	\$0	\$0	10.4 h	0 h	0 h	0 h	10.4 h	
	7	ElecTechF	50%	\$20,280	\$0	\$0	\$20,280	520 h	0 h	0 h	0 h	520 h	

WBS Finish M&S EQ M&S Labor **FNAL Labor Total Cost** Name Start "Assemble and test power supplies" continued Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work PhysicistU 104 h 104 h 10 10% \$0 \$0 \$0 \$0 0 h 0 h 0 h 15 MandS 4,304.38 \$4,304 \$0 \$0 \$4,304 4,304.38 0 0 4,304.38 Notes WBS Definition-

Assemble and test power supplies for MTCxx crates

M&S Labor BOE-

Run 2a supplies took about 1 month per supply on average to assemble and test with a full-time technician assigned to the task needed for parts ordering is 10.4h of ElecEngU = \$124.38 in addition to ElecTechF. Some parts are orded by the ElecTechF from the fermilab stockroom.

M&S Equipment BOE-

Costs were estimated using run 2a costs. There is some uncertainty as to whether we must re-order the display and monitor PCB's. See BOE binder for a spreadsheet of the costs. Basically i added many/most of the costs for 6 crates and divided by 6. 2 supply cases (each containing 2 supplies) will be built at \$2190 / case. This includes display and monitor electronics.

M&S equipment total = \$4180

M&S total = \$4304.38

1.2.2.8.7		Procure MSPI	_IT crate	s, backp	planes, and po	wer suppl	6/2	/03	9/23/03	\$4	09	\$401	\$0	\$810
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	- 8	ElecTechU	5%	\$0	\$0	\$0	\$0	32 h	0 h	0 h	0 h	32 h		
	15	MandS	809.6	\$810	\$0	\$0	\$810	809.6		0	0	809.6		

Notes

WBS Definition

Procure crate, power backplane, and power supplies for MSPLIT cards for MTCxx cards.

M&S Labor BOE-

Same ElecTechU who ordered parts for run2a will do so again for run 2b.

M&S labor = 32h of ETU = \$400.80

M&S labor pays ETU salary + ere + overhead

The backplanes will be spares from Run 2a but they must be assembled by the ElecTechU.

M&S Equipment BOE-

See BOE binder. Based on run 2a costs x 1.1 except the power supply which we estimate using the supply catalog price.

M&S equipment total = \$408.80

M&S total = \$809.60

1.2.2.8.8		Procure MSPL	.IT card pa	ırts			5/15/03		8/8/03	\$7,207	\$	301	\$0	\$7,508
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	4	ElecEngU	5%	\$0	\$0	\$0	\$0	24 h	0 h	0 h	0 h	24 h		
	15	MandS	7,507.8	\$7,508	\$0	\$0	\$7,508	7,507.8		0	0	7,507.8		

Notes

WBS Definition-

Procure the parts needed for MSPLIT cards

M&S Labor BOE-

Same ElecTechU as in run2a will be responsible for procurement and has all records of prices and vendors.

M&S labor = 24h of EEU = \$300.6

M&S labor pays ETU salary + ere + overhead

M&S Equipment BOE

See BOE binder for spreadsheet. Cost based on Run2a MSPLIT costs x 1.1

14 boards @ \$514.8 = \$7207.2

M&S total = \$7507.8

								b iliggei							
/BS		Name					Sta	rt	inish	M&S EQ	М&	S Labor	FNAL	Labor	Total Cost
.2.2.8.9		Fabricate and	l assemble N	MSPLIT o	ards		8/11/0	3 1	/3/03	\$11,319		\$1,489		\$0	\$12,808
	ID 4	Resource Name ElecEngU	Units 5%	Cost \$0	Baseline Cost \$0	Act. Cost	Rem. Cos	st Work \$0 24	Ovt. Wo	ork Baseline 0 h	Work A	ct. Work 0 h	Rem. Work	_	
	8	ElecTechU	20%	\$0	\$0)	50	\$0 96	h	0 h	0 h	0 h	96 /	ำ	
	15	MandS	12,808.44	\$12,808	\$6)	\$12,8	308 12,808.4	4		0	0	12,808.4	4	
		: Definition- ate 14 splitter cards	including 2 spa	ares.											
	Same of M&S la	abor BOE engineer as in Run abor = 24h of EEU a abor pays 20% of El abor pays full ETU s	and 96h of ETU EU salary + ere	= \$1489.44 e + overhea	ļ	ation and as	sembly. Sam	e ElecTechU as	in Run 2a w	vill do the assem	ibly. The fu	ıll-time assı	embly rate in	Run 2a wa	s 1 board per day
		quipment BOE- rds @ \$808.5 = \$1	1319												
	Unit co	sts based on actua	I costs of run2a	a MSPLIT fa	abrication x 1.1. A	Assembly will	be by Arizona	a technician. S	e BOE bind	ler for run2a p.o					
	M&S to	otal = \$12808.44													
.2.2.8.10		Test MSPLIT	cardo				11/4/0	12	/9/04	\$0		\$993		\$0	\$993
.2.2.0.10	ID	Resource Name		Cost B	aseline Cost A	ct. Cost	Rem. Cost			φυ Baseline Work	Act. Work	Rem. V	Vork	φU	φ993
	4	ElecEngU	5%	\$0	\$0	\$0	\$0	16 h	0 h	0 h	0 1	1	16 h		
	8 10	ElecTechU PhysicistU	20% 5%	\$0 \$0	\$0 \$0	\$0 \$0	\$0 \$0	64 h 16 h	0 h 0 h	0 h 0 h	0 I 0 I		64 h 16 h		
	15	MandS	992.96	\$993	\$0	\$0	\$993	992.96		0	() 9	92.96		
	M&S L Based M&S Ia M&S Ia	Definition- nctionality of MSPL abor BOE- on Run2a MSPLIT abor = 16h of EEU a abor pays 20% of El abor pays full ETU s	rate of 2 board and 64h of ETU EU salary + ere	s/day (full t = \$992.96 e + overhea	ime) for complete	testing. Add	litional time ne	eeded for debuç	ging and fixe	es.					
		quipment BOE- are no M&S equipm	nent costs asso	ciated with	this task.										
	M&S to	otal = \$992.96													
.2.2.9	Notes	:	al-Trk Matc	h Produc	ction and Tes	ting C	7/14/0	4 7	14/04	\$0		\$0		\$0	\$0
		Definition- one: track matching	system comple	ete except f	or intallation and o	commissionii	ng								
		Laurel 4 Towns	kina				11/12/0	2 3	16/05	\$569,208	\$:	242,995	¢ E	7,980	
.2.3	Notes		Killy							•	•	242,999	φo	,,,,,,,	\$870,183
1.2.3	WBS E		ovides for impro	ovements ir As.	the existing track	k trigger. It ir	ncludes desigr	n and developm	ent of algorit			,	•	•	

milestone: once this is done, FPGAs can be chosen

1.2.3.2		Name					Start		Finish	M&S EQ	M&S Labor	FNA	L Labor	Total Cost
1.2.3.2		Definition-	Target CTT Algorithm or the FPGA's to implement the track finding equations a		aguatiana and d	11/13/02		7/17/03	\$0	\$85,272	\$0		\$85,272	
	Develo	pp vhbL code for the	FFGASIOII	приетнени	ne track infully t	equations and t	othe board function	UIIS.						
1.2.3.2.1		Develop firmw	are for tar	get CTT a	algorithm		11/13/02		6/11/03	\$0	\$72,352		\$ 0	\$72,352
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work		m. Work	-	
	4 15	ElecEngU MandS	100% 72,352	\$0 \$72,352	\$0 \$0		\$0 \$72,352	1,120 h 72,352	0 h	0 h 0	0 h 0	1,120 h 72,352		
		s Definition- n the DFEA board firm	nware to use	more powe	erful FPGA's and	I provide the ou	utputs to I1muon	and I2ctt.						
	increas M&S B	ngineer who designed sed by a month for th	e engineer to	get familia	ar with the cablin	g and the input	structure (which				nths to complete th	e firmware.	The current v	work estimate was
1.2.3.2.2	Labor	Fit CTT firmwa					6/12/03		7/17/03	\$0	\$12,920		\$0	\$12,920
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work Re	m. Work		
	4 15	ElecEngU MandS	100% 12,920	\$0 \$12,920	\$0 \$0	\$0 \$0	\$0 \$12,920	200 h 12,920	0 h	0 h 0	0 h 0	200 h 12,920		
							and the ouptut re	sult sort I	eading to the se	election of the FPG	SA to be used. Timi	ng studies r	need to be car	ried out to make su
	Labor E The res	nm and associated or BOE- source allocation, FF due to the increased	verhead fits i	n the speci	fied 790ns windo	ow.	·		Ü					
	Labor E The res weeks M&S B	BOE- source allocation, FF due to the increased	verhead fits in PGA selection I complexity of	n the speci n and the tin of the L1CT	fied 790ns windo ming studies /tun T design.	ow. Ó	·		Ü					
2.3.3	Labor E The res weeks M&S B	BOE- source allocation, FF due to the increased BOE- charges based on at Target L1 Cer	verhead fits in PGA selection I complexity of the BU EDF	n the speci n and the tip of the L1CT	fied 790ns windoming studies /tun T design. D/hr and an overl	ow. ing of the firwa	·		Ü					
2.3.3	Labor E The res weeks M&S B Labor C	BOE- source allocation, FF due to the increased BOE- charges based on at Target L1 Cer Definition-	verhead fits in PGA selection I complexity of the BU EDF	n the speci n and the tip of the L1CT	fied 790ns windoming studies /tun T design. D/hr and an overl	ow. ing of the firwa	re will be done b		ne engineer who	o worked on the ST	ΓC. This task took 3		the STC. We	
	Labor E The res weeks M&S B Labor o	BOE- source allocation, FF due to the increased soE- charges based on at Target L1 Cer Definition- one: Develop Test	verhead fits i PGA selection I complexity of the BU EDF	n the speci n and the tin of the L1CT rate of \$40 c Trigger	fied 790ns windoming studies /tun T design. D/hr and an overl	ow. ing of the firwa	re will be done b		ne engineer who	o worked on the ST	ΓC. This task took 3		the STC. We	have added 2 more
	Labor E The res weeks M&S B Labor c Notes WBS D milesto Notes WBS D Develo	BOE- source allocation, FF due to the increased BOE- charges based on at Target L1 Cer Definition- one: Develop Test Definition- op test procedure coctests. However, since	PGA selection I complexity of the BU EDF ntral Track Procedur de, based on	n the speci n and the tin of the L1CT rate of \$40 Trigger	ming studies /tun T design. O/hr and an overl Algorithm F	ow. ing of the firware and of 61.5%. Firmwares for testing the	7/17/03 7/18/03 e full functionality	y the san	7/17/03 8/28/03 ototype boards	\$0 \$0 will be developed.	\$0 \$1,550 We will use the sa	weeks for	\$0 \$0 and hardware a	\$0 \$1,550 as used for the Rur
2.3.4	Labor E The res weeks W&S B Labor C Notes WBS D milesto Notes WBS D Develo DFEA t	BOE- source allocation, FF due to the increased BOE- charges based on at Target L1 Cer Definition- pone: Develop Test Definition- pop test procedure coctests. However, since	PGA selection I complexity of the BU EDF ntral Track Procedur de, based on e the internal	n the speci n and the tin of the L1CT rate of \$40 Trigger	ming studies /tun T design. O/hr and an overl Algorithm F	es for testing the anged, the test	7/17/03 7/18/03 e full functionality	y the san	7/17/03 8/28/03 ototype boards	\$0 \$0 will be developed.	\$0 \$1,550 We will use the salest procedure will I	weeks for	\$0 \$0 and hardware a	\$0 \$1,550 as used for the Rui
2.3.4	Labor E The res weeks M&S B Labor C Notes WBS D milesto Notes WBS D Develo DFEA t firmwar	BOE- source allocation, FF due to the increased soE- charges based on at Target L1 Cer cefinition- one: Develop Test cefinition- op test procedure coc tests. However, since re. Develop test p Resource Name	Procedur Ice, based on ethe internal Ice, based on ethe internal Irocedures Units	n the speci n and the tin of the L1CT rate of \$40 (Trigger 	ming studies /tun T design. Ohr and an overl Algorithm F the test procedure mare will be cha	nead of 61.5%. Firmwar es for testing thanged, the test Act. Cost	7/17/03 7/18/03 e full functionality procedures have	y the san	7/17/03 8/28/03 ototype boards vritten. The spe	\$0 \$0 will be developed.cifications for the topographic state of the	\$1,550 We will use the salest procedure will to \$1,550 Act. Work Re	m. Work	\$0 \$0 and hardware aby the enginee	\$0 \$1,550 as used for the Ruir who develops the
2.3.4 2.3.4	Labor E The res weeks M&S B Labor C Notes WBS D milesto Notes WBS D Develo DFEA t firmwar	BOE- source allocation, FF due to the increased soE- charges based on at Target L1 Cer cefinition- one: Develop Test cefinition- op test procedure coc tests. However, since re. Develop test p Resource Name ElecEngU MandS	Procedur Procedur Ice, based on e the internal	n the speci n and the tin of the L1CT rate of \$40 c Trigger	ming studies /tun T design. D/hr and an overl Algorithm F	es for testing the anged, the test	7/17/03 7/18/03 e full functionality procedures have	y the san	7/17/03 8/28/03 ototype boards written. The spe	\$0 \$0 will be developed.cifications for the t	\$0 \$1,550 We will use the salest procedure will I	ame test sta	\$0 \$0 and hardware aby the enginee	\$0 \$1,550 as used for the Ruir who develops the

Develop test procedure code, based on Run2a

Labor BOE-

The specifications for the test procedure will be defined by the engineer who develops the firmware, together with a BU physicist. The estimate of engineering fraction is based on hours spent by the engineer for the STC test procedure developments.

Develop t	Notes M&S La	abor BOE- charges based on th Develop test p	e BU EDF ra	- ate of \$40/h	r and an everbea									
.2.3.4.2	M&S Labor o	abor BOE- charges based on th Develop test p		_ ate of \$40/h	r and an everhea									
.2.3.4.2	Labor o	Develop test p		ate of \$40/h	r and an overhea									
.2.3.4.2					i aliu ali ovelilea	d of 61.5%.								
			rocedures	;			7/18/03		8/28/03	\$0	\$0		\$0	\$0
	10	Resource Name					em. Cost Wor				Work Rem. Wor			
		PhysicistU	100%	\$0	\$0	\$0	\$0 24	10 h	0 h	0 h	0 h 24	0 h		
	Notes WRS D	Definition-		-										
		p test procedure cod	le, based on	Run2a										
	Labor E	30E-												
	The sp	ecifications for the te		e will be def	ined by the engin	eer who devel	<u> </u>	together				the previous		<u> </u>
.2.3.5		DFEA Prototy	pe I				7/18/03		2/20/04	\$56,089	\$50,259		\$0	\$106,348
	Notes WBS D	Definition-		-										
	Design	and build complete	functional pr	ototypes for	r the Digital Front	-End Axial dau	ughter boards.							
.2.3.5.1		Layout					7/18/03		9/12/03	\$0	\$22,739		\$0	\$22,739
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work Ren	n. Work		
	4 8	ElecEngU ElecTechU	100% 10%	\$0 \$0	\$0 \$0	\$0 \$0	\$0 \$0	320 h 32 h	0 h 0 h	0 h 0 h	0 h 0 h	320 h 32 h		
	15	MandS	22,739	\$22,739	\$0	\$0	\$22,739	22,739	011	0	0	22,739		
	Notes			_										
		Definition- t prototype 1 of DFE	٨											
	Labor E	BOE- STC card layout exp	perience It to	ook ahout 5	weeks for lavout	and verification	in for the STC ca	rd DEEA	will have chins	with a factor of 2	output nins on the F	PGAs as well	l as the hoar	d lavout will be mo
		ex - so we have adde				ana vermoade		14. D1 L7	wiii navo ompo	, with a labtor of 2 c		Cr to do wen	do the boah	a layout will be mo
	M&S B	OE-												
		charges based on th	e BU EDF ra	ate of \$40/h	r and an overhea	d of 61.5%.								
.2.3.5.2		Procure protot	ype DFEA	FPGAs			7/18/03		10/10/03	\$48,000	\$0		\$0	\$48,000
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work Ren	n. Work		
	15	MandS	48,000	\$48,000	\$0	\$0	\$48,000	48,000		0	0	48,000		
	Notes			=										
		Definition- e the Xilinx chips for	assembly of	f 6 prototyr	oe DFEA. We will	assemble only	v 3 boards for the	e prototyp	e I round, and	3 in the second. Ho	owever since the lea	d times are la	arge, procuri	ng the FPGA all du
		t round is necessary											0 /1	J
	Labor E n/a	BOE-												
	M&S B	OF -												
	Cost fo	or 24 XC2V6000 FPG ent in BOE binder.	SA, based on	ı 2000\$ per	FPGA. If the FPC	GA prices rema	ain high at the tin	ne of pure	chase, we will p	orototype a scaled-o	down version of the	board with 2	pT bins inste	ead of 4. See supp
							7/40/00		10/10/00					
2.3.5.3		Procure protot	ype DFEA	\ FPGAs			7/18/03		10/10/03	\$0	\$0		\$0	\$0
2.3.5.3	ID	Procure protot	• •		seline Cost A	ct. Cost Re	7/18/03 em. Cost Worl			·	\$0 Work Rem. Work	1	\$0	\$0
2.3.5.3	ID 10	•	• •		seline Cost Ad	ct. Cost Re	em. Cost Worl			·	·		\$0	\$0

Procure the Xilinx chips for assembly of 6 prototype DFEA. We will assemble only 3 boards for the prototype I round, and 3 in the second. However since the lead times are large, procuring the FPGA all during

NBS		Name					Sta	ırt	Finish	M&S EQ	M&S L	.abor	FNAL Labor	Total Cost
Procure p	prototyp	e DFEA FPGA	s" continue	ed										
	Notes	t round is necessar			. 10 -t - ti	b-:- 40 41	-0/ -141	0	- Indiana					
	the ilis	t round is necessar	y and buying	more mar	i io at a time ge	neraly is 10-13	o% cheaper tha	in 9 or less	cnips.					
	Labor I n/a	BOE-												
	M&S B	OE - evious task												
	300 pro													***
.2.3.5.4		Procure proto	3 .	•			9/15/0		10/10/03	\$0	·	2,067	\$0	\$2,067
	ID 8	Resource Name ElecTechU	Units 20%	Cost \$0	Baseline Cost \$0	Act. Cost	Rem. Cost \$0	Work 32 h	Ovt. Work	Baseline Work h 0 h	Act. Work	Rem. W	Vork 32 h	
	15	MandS	2,067.2	\$2,067	\$0 \$0	\$0	\$2,067	2,067.2		(,067.2	
	Notes			_										
		efinition- e the parts for buildi	ing two proto	type DFEA	١.									
		•	3											
	Labor I BU tec	30E- hnical staff will be re	esponsible fo	r procuren	nent of parts and	has experience	ce for procuring	parts for th	ne Run1a STC	. Estimate based o	n time spent to	order ST	C parts.	
								, ,						
	M&S B Labor o	obe - charges based on t	he BU EDF ra	ate of \$40	hr and an overhe	ad of 61.5%.								
.2.3.5.5							9/15/0	12	10/10/03	\$1,500		\$0	\$0	\$1,500
.2.3.5.5	ID	Procure proto Resource Name			Baseline Cost	Act Coot	Rem. Cost	Work	Ovt. Work			Rem. Work	•	\$1,500
	15	MandS	Units 1,500	\$1,500	\$0	Act. Cost \$0	\$1,500	1,500	OVI. WOIK	Baseline Work 0	Act. Work	1,50		
	Notes													
	WBS D	efinition-		. 5554										
	Procur	e the parts for buildi	ing two proto	type DFEA	١.									
	Labor I	BOE-												
	n/a													
	M&S B		rototuno nort	to for the C	TC \$750/boord									
	Cost ba	ased on per board p		is for the S	11C - \$750/board.	•								
.2.3.5.6		PCB fabrication	on				10/13/0	03	10/24/03	\$0	\$1	,034	\$0	\$1,034
	1D 8	Resource Name ElecTechU	Units 20%	Cost \$0	Baseline Cost \$0	Act. Cost	Rem. Cost \$0	Work 16 h	Ovt. Work	Baseline Work h 0 h	Act. Work	Rem. V	<u>Vork</u> 16 h	
	15	MandS	1,033.6	\$1,034	\$0			1,033.6		(,033.6	
	Notes			_										
		Definition- Obrication of the DFE	- A board at w	ondor oito										
	PCB Ia	iblication of the DF	EA DOAIU AL V	endor site	-									
	Labor I	30E- on Run2a STC - ind	dudos colloct	ing the file	e pooded by the	vondor for PC	D fabrication a	nd to bo do	no by the cam	o porcon as for the	STC			
	Daseu	OII Ruiiza 310 - IIIC	Judes Collect	ing the me	is needed by the	vendorior FC	B labilcation, a	na to be ao	ne by the sam	ie person as ioi the	310.			
	M&S B	OE - charges based on it	ho DII EDE r	ato of \$40	/br and an overhe	ad of 61 5%								
	Labor			ate of \$40	ili aliu ali overile	au 01 01.5 /0.								
.2.3.5.7		PCB fabrication					10/13/0		10/24/03	\$5,801		\$0	\$0	\$5,801
	ID 15	Resource Name MandS	Units 5,801	Cost \$5,801	Baseline Cost \$0	Act. Cost \$0	Rem. Cost \$5,801	Work 5,801	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
			3,001	φυ,ου I	\$0	<i>\$0</i>	\$3,00 <i>1</i>	3,001		U	U	3, 60	01	
	Notes WBS D	efinition-		_										
		brication of the DFE	EA board at v	endor site										
	Labor I	30E-												

VBS		Name						Start	Finish	M&S EQ	M&S Lat	or FNA	L Labor	Total Cost
PCB fabri	cation'	continued												
	Notes n/a			_										
	n/a													
	M&S B Based		dor quote - 9	3731+240+	450 + 1080+30	00 = 5801 I	ncludes bare b	ooard stencil	tooling test St	tencil -NRE, prograr	nming-NRF See	BOF binder		
1.2.3.5.8		Assembly	44010					27/03	11/14/03	\$0	\$1,1		\$0	\$1,163
1.2.3.3.0	ID	Resource Name	Units	Cost	Baseline Cost	Act. Co			Ovt. Work	Baseline Work	Act. Work	Rem. Work	ΨΟ	Ψ1,103
	8	ElecTechU	15%	\$0	,	\$0	\$0	\$0 18	3 h 0	h 0 h	0 h	18 h		
	15	MandS	1,162.8	\$1,163	\$	\$0	\$0 \$1	,163 1,162	2.8	a	0	1,162.8		
		Definition- bly of the DFEA pro	ototype board	– Is at venodr	site.									
	Labor I		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,											
		on Run2a STC - ind	cludes collec	ting the part	ts needed by t	he vendor fo	or PCB assemb	oly. Will be do	ne by the same	e person as STC.				
	M&S B	OF -												
		charges based on t	he BU EDF	ate of \$40/h	nr and an overh	nead of 61.5	%.							
1.2.3.5.9		Assembly					10/2	27/03	11/14/03	\$788		\$0	\$0	\$788
	ID	Resource Name	Units	Cost B	aseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work E	Baseline Work Ad	t. Work Rem.	Work		
	15	MandS	788	\$788	\$0	\$0	\$788	788		0	0	788		
	Notes													
	WBS F	efinition-		_										
		bly of the DFEA pro	totype board	ls at vendor	site.									
	M&S B Based	OE - on Run2a STC ven	dor quote - s	ee BOE bin	ider.									
1.2.3.5.10		Test					11/	17/03	2/20/04	\$0		\$0	\$0	\$0
	ID	Resource Name	Units		aseline Cost	Act. Cost	Rem. Cost					Work		
	10	PhysicistU	50%	\$0	\$0	\$0	\$0	240 h	0 h	0 h	0 h	240 h		
	Notes	efinition-		_										
		prototype board tes	ting.											
	Labor I	ROF.												
		s of university phys	icist.											
	M&S B	OE.												
	n/a	OL-												
1.2.3.5.11		Test					11/	17/03	2/20/04	\$0	\$23,2	56	\$0	\$23,256
	ID	Resource Name	Units	Cost	Baseline Cos	t Act. Co			Ovt. Work	Baseline Work	Act. Work	Rem. Work	*	, ,
	4	ElecEngU	75%	\$0		\$0 \$0	\$0	\$0 360		h 0 h		360 h		
	15	MandS	23,256	\$23,256		\$0	\$0 \$23	3,256 23,2	56	Ü	0	23,256		
	Notes	efinition-		_										
		prototype board tes	ting.											
			-											
	Labor I Based	3OE- on Run2a STC - It t	took 3 month	s of a full tir	me physicist an	nd an engine	er working at 7	75% for testing	the first protot	types of the STC				
				iuii (ii	, 510101 01	u ongine		- 70 .07 toothi	, or protot	.,,,				
	M&S B		h			and of 04 5	0/							
	Lapor	charges based on t	ue BO EDF	are or \$40/f	ıı and an overr	iead of 61.5	70.							

		Name					Star		Finish	M&S EQ		Labor		Labor	Total Cost
.2.3.6		DFEA Prototy	/pe II				12/17/03	3	4/16/04	\$7,823	\$2	5,918	\$1	7,880	\$51,620
	Notes WRS D	efinition-		_											
		and build complete	functional p	rototypes fo	r the Digital Fron	it-End Axial da	ughter boards.								
1.2.3.6.1		Layout					12/17/03	2	1/23/04	\$0	¢1:	2,920		\$0	\$12,920
1.2.3.0.1	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work		Work	φυ	φ12,920
	4	ElecEngU	100%	\$0	\$0		\$0	160 h	0 h	0 h	0 F		160 h		
	8 15	ElecTechU MandS	25% 12,920	\$0 \$12,920	\$0 \$0		\$0 \$12,920	40 h 12,920	0 h	0 h	01		40 h 12,920		
			12,920	\$12,920	\$0	, şu	\$12,920	12,920		U		,	12,920		
	Notes WBS D	efinition-		_											
		ations to the first lay	out, uncove	red while te	sting. Any chang	ges which need	d to be made du	ie to our ex	perience with t	testing, verification	of the new la	ayout.			
	M&S B	OF-													
		charges based on the	ne BU EDF r	ate of \$40/h	r and an overhea	ad of 61.5%.									
	Labor E	ROF-													
		STC card layout ex	perience. Es	timate base	d on time taken f	for the STC. It	took 4 weeks to	o make the	necessary cha	anges and verificat	ion of the lay	out.			
1.2.3.6.2		PCB fabrication	'n				1/26/04	1	2/6/04	\$1,034		\$0		\$0	\$1,034
1.2.3.0.2	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	• Work	Ovt. Work	Baseline Work	Act. Work		Work	φυ	φ1,05 4
	8	ElecTechU	20%	\$0	\$0	\$0	\$0	16 h	0 h	0 h	0 F		16 h		
	15	MandS	1,033.6	\$1,034	\$0	\$0	\$1,034	1,033.6		0	()	1,033.6		
	Notes			_											
		efinition-													
			A hoard pro	totyne II at v	vendor site										
	PCB fa	brication of the DFE	A board pro	totype II at v	vendor site.										
	PCB fa	brication of the DFE				yandar far DCP	fabrication								
	PCB fa	brication of the DFE				endor for PCB	fabrication.								
	PCB fa Labor E Based M&S B	brication of the DFE 3OE- on Run2a STC - inc OE -	ludes collec	ting the files	needed by the v		fabrication.								
	PCB fa Labor E Based M&S B	brication of the DFE 3OE- on Run2a STC - inc OE - charges based on the	ludes collect	ting the files	needed by the v										
1.2.3.6.3	PCB fa Labor E Based M&S B	brication of the DFE 3OE- on Run2a STC - inc OE -	ludes collect	ting the files	needed by the v		fabrication. 1/26/04	1	2/6/04	\$5,801		\$0		\$0	\$5,801
1.2.3.6.3	PCB fa Labor E Based M&S B Labor C	brication of the DFE BOE- on Run2a STC - inc OE - charges based on the PCB fabrication Resource Name	ne BU EDF r	ate of \$40/h	r and an overhea	ad of 61.5%. Act. Cost	1/26/04 Rem. Cost	Work		Baseline Work	Act. Work	Rem. Wo		\$0	\$5,801
1.2.3.6.3	PCB fa Labor E Based M&S B Labor C	brication of the DFE BOE- on Run2a STC - inc OE - charges based on the PCB fabrication Resource Name MandS	ne BU EDF r	ting the files	s needed by the variety	ad of 61.5%.	1/26/04				Act. Work	Rem. Wo	rk	\$0	\$5,801
1.2.3.6.3	PCB fa Labor E Based M&S B Labor c ID 15 Notes	brication of the DFE BOE- on Run2a STC - inc OE - charges based on the PCB fabrication Resource Name MandS	ne BU EDF r	ate of \$40/h	r and an overhea	ad of 61.5%. Act. Cost	1/26/04 Rem. Cost	Work		Baseline Work		Rem. Wo		\$0	\$5,801
1.2.3.6.3	PCB fa Labor B Based M&S B Labor c ID 15 Notes WBS D	brication of the DFE BOE- on Run2a STC - inc OE - charges based on the PCB fabrication Resource Name MandS	ne BU EDF r on Units 5,801	ate of \$40/h Cost \$5,801	nr and an overhea	ad of 61.5%. Act. Cost	1/26/04 Rem. Cost	Work		Baseline Work		Rem. Wo		\$0	\$5,801
1.2.3.6.3	PCB fa Labor E Based M&S B Labor C ID 15 Notes WBS D PCB fa	brication of the DFE BOE- on Run2a STC - inc OE - charges based on the PCB fabrication Resource Name MandS Definition- brication of the DFE	ne BU EDF r on Units 5,801	ate of \$40/h Cost \$5,801	nr and an overhea	ad of 61.5%. Act. Cost	1/26/04 Rem. Cost	Work		Baseline Work		Rem. Wo		\$0	\$5,801
1.2.3.6.3	PCB fa Labor E Based M&S B Labor C ID 15 Notes WBS D PCB fa Labor E	brication of the DFE BOE- on Run2a STC - inc OE - charges based on the PCB fabrication Resource Name MandS Definition- brication of the DFE	ne BU EDF r On Units 5,801	ate of \$40/h Cost \$5,801	nr and an overhea	ad of 61.5%. Act. Cost	1/26/04 Rem. Cost	Work		Baseline Work		Rem. Wo		\$0	\$5,801
1.2.3.6.3	PCB fa Labor E Based M&S B Labor C ID 15 Notes WBS D PCB fa Labor E n/a	brication of the DFE 3OE- on Run2a STC - inc OE - charges based on the PCB fabrication Resource Name MandS Definition- brication of the DFE	ne BU EDF r On Units 5,801	ate of \$40/h Cost \$5,801	nr and an overhea	ad of 61.5%. Act. Cost	1/26/04 Rem. Cost	Work		Baseline Work		Rem. Wo		\$0	\$5,801
1.2.3.6.3	PCB fa Labor I Based M&S B Labor 0 ID 15 Notes WBS D PCB fa Labor I n/a M&S B	brication of the DFE BOE- on Run2a STC - inc OE - charges based on the PCB fabrication Resource Name MandS Definition- brication of the DFE BOE- OE -	ne BU EDF r on Units 5,801	ate of \$40/h Cost \$5,801 totype II at v	ar and an overhear Baseline Cost \$0 vendor site.	Act. Cost \$0	1/26/04 Rem. Cost \$5,801	Work 5,801	Ovt. Work	Baseline Work 0	0	Rem. Wo	801	\$0	\$5,801
	PCB fa Labor I Based M&S B Labor 0 ID 15 Notes WBS D PCB fa Labor I n/a M&S B	brication of the DFE 3OE- on Run2a STC - inc OE - charges based on the PCB fabrication Resource Name MandS Definition- brication of the DFE	ne BU EDF r on Units 5,801	ate of \$40/h Cost \$5,801 totype II at v	ar and an overhear Baseline Cost \$0 vendor site.	Act. Cost \$0	1/26/04 Rem. Cost \$5,801 des bare board,	Work 5,801 stencil, too	Ovt. Work	Baseline Work 0 0 ncil -NRE, program	0	Rem. Wo	801		
	PCB fa Labor I Based M&S B Labor 0 ID 15 Notes WBS D PCB fa Labor I n/a M&S B	brication of the DFE BOE- on Run2a STC - inc OE - charges based on the PCB fabrication Resource Name MandS Definition- brication of the DFE BOE- OE -	ne BU EDF r on Units 5,801 EA board pro	Cost \$5,801 totype II at v	ar and an overhear Baseline Cost \$0 vendor site.	Act. Cost \$0	1/26/04 Rem. Cost \$5,801	Work 5,801 stencil, too	Ovt. Work	Baseline Work 0	0	Rem. Wo	801	\$0 \$0	
	PCB fa Labor E Based M&S B Labor C ID 15 Notes WBS D PCB fa Labor E n/a M&S B Based	brication of the DFE BOE- on Run2a STC - inc OE - charges based on the PCB fabrication Resource Name MandS Definition- brication of the DFE BOE- OE - on Run2a STC vence Procure parts Resource Name	units 5,801 A board pro dor quote - \$ for the pro Units	ate of \$40/h Cost \$5,801 totype II at v 3731+240+ btotpes Cost B	Baseline Cost vendor site. 450 + 1080+300 aseline Cost	ad of 61.5%. **Act. Cost** **0** = 5801. Include **Act. Cost** **Ref. Cost**	1/26/04 Rem. Cost \$5,801 des bare board, 1/16/04 lem. Cost W	Work 5,801 stencil, too look Over Over	oling, test, Ster	Baseline Work 0 ncil -NRE, program \$200 seline Work Act	0 ming-NRE- s	Rem. Wood 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5,	801 binder.		
	PCB fa Labor E Based M&S B Labor C ID 15 Notes WBS D PCB fa Labor E n/a M&S B Based	brication of the DFE BOE- on Run2a STC - inc OE - charges based on the PCB fabrication Resource Name MandS Definition- brication of the DFE BOE- OE - on Run2a STC vence Procure parts Resource Name MandS	on Units 5,801 EA board prodor quote - \$ for the pro	cost \$5,801 totype II at v	Baseline Cost \$0 vendor site.	Act. Cost \$0 = 5801. Include	1/26/04 Rem. Cost \$5,801 des bare board, 1/16/04	Work 5,801 stencil, too	oling, test, Ster	Baseline Work 0 ncil -NRE, program \$200	0 ming-NRE- s	Rem. Wo	801 binder.		
	PCB fa Labor E Based M&S B Labor C ID 15 Notes WBS D PCB fa Labor E n/a M&S B Based	brication of the DFE 3OE- on Run2a STC - inc OE - charges based on the PCB fabrication Resource Name MandS Definition- brication of the DFE 3OE- OR Run2a STC vence Procure parts Resource Name MandS	units 5,801 A board pro dor quote - \$ for the pro Units	ate of \$40/h Cost \$5,801 totype II at v 3731+240+ btotpes Cost B	Baseline Cost vendor site. 450 + 1080+300 aseline Cost	ad of 61.5%. **Act. Cost** **0** = 5801. Include **Act. Cost** **Ref. Cost**	1/26/04 Rem. Cost \$5,801 des bare board, 1/16/04 lem. Cost W	Work 5,801 stencil, too look Over Over	oling, test, Ster	Baseline Work 0 ncil -NRE, program \$200 seline Work Act	0 ming-NRE- s	Rem. Wood 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5,	801 binder.		
1.2.3.6.3	PCB fa Labor I Based ID 15 Notes WBS D PCB fa Labor I M&S B Based ID 15 Notes WBS D Notes WBS D Notes WBS D	brication of the DFE BOE- on Run2a STC - inc OE - charges based on the PCB fabrication Resource Name MandS Definition- brication of the DFE BOE- OE - on Run2a STC vence Procure parts Resource Name MandS	units 5,801 A board product - \$ for the prounits 200	### Cost	Baseline Cost vendor site. 450 + 1080+300 aseline Cost	ad of 61.5%. **Act. Cost** **0** = 5801. Include **Act. Cost** **Ref. Cost**	1/26/04 Rem. Cost \$5,801 des bare board, 1/16/04 lem. Cost W	Work 5,801 stencil, too look Over Over	oling, test, Ster	Baseline Work 0 ncil -NRE, program \$200 seline Work Act	0 ming-NRE- s	Rem. Wood 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5,	801 binder.		\$5,801 \$200
	PCB fa Labor I Based ID 15 Notes WBS D PCB fa Labor I M&S B Based ID 15 Notes WBS D Notes WBS D Notes WBS D	brication of the DFE BOE- on Run2a STC - inc OE - charges based on the PCB fabrication Resource Name MandS Definition- brication of the DFE BOE- OR - on Run2a STC vence Procure parts Resource Name MandS Definition- e the parts for building	units 5,801 A board product - \$ for the prounits 200	### Cost	Baseline Cost vendor site. 450 + 1080+300 aseline Cost	ad of 61.5%. **Act. Cost** **0** = 5801. Include **Act. Cost** **Ref. Cost**	1/26/04 Rem. Cost \$5,801 des bare board, 1/16/04 lem. Cost W	Work 5,801 stencil, too look Over Over	oling, test, Ster	Baseline Work 0 ncil -NRE, program \$200 seline Work Act	0 ming-NRE- s	Rem. Wood 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5,	801 binder.		

Cost based on per board prototype parts for the STC during the second round of prototype- \$100/board - as most of the parts would have been bought in the first round of prototype. Resistors, capacitors, voltage

		Name					Sta	art	Finish	M&S EQ	M&S La	abor	FNAL Labo	or	Total Cost
rocure p		r the prototpes"	continued												
	Notes regulat	ors sometimes need	d to be bulk o	_ ordered											
	regulat														
1.2.3.6.5		Procure parts	for the pro	ototpes			1/16/0	04	2/6/04	\$0		\$78	\$	0	\$78
	ID	Resource Name	Units		Baseline Cost	Act. Cost	Rem. Cost					m. Work	_		
	8 15	ElecTechU MandS	1% 77.52	\$0 \$78	\$0 \$0	\$0 \$0	\$0 \$78	1.2 h 77.52	0 h	0 h 0	0 h 0	1.2 h 77.52			
	Notes			,		,	,								
		Definition-		_											
	Procure	e the parts for buildi	ing two proto	type DFEA											
	Labor E	BOE-													
	BU tec	hnical staff will be re	esponsible fo	r procurem	nent of parts and	d has experie	nce for procuring	g parts for th	e Run1a STC.	-					
	M&S B	OE -													
		charges based on the	he BU EDF r	ate of \$40/	hr and an overh	ead of 61.5%									
.2.3.6.6		Assembly					2/9/0	04	2/20/04	\$788		\$0	\$	60	\$788
	ID	Resource Name	Units	Cost E	Baseline Cost	Act. Cost					t. Work Ren	n. Work	•		ψ. σσ
	15	MandS	788	\$788	\$0	\$0	\$788	788		0	0	788	_		
	Notes	:													
		Definition-	4-4		:4-										
	Assem	bly of the DFEA pro	ototype board	s at vendo	r site.										
	Labor E	BOE-													
	n/a														
	M&S B														
		OE - on Run2a STC vend	dor quote - s	ee BOE bii	nder.										
1.2.3.6.7			dor quote - s	ee BOE bii	nder.		2/9/0	04	2/20/04	\$0	\$1,	034	\$	60	\$1,034
.2.3.6.7		on Run2a STC vend	dor quote - s	ee BOE bii	nder. Baseline Cost	Act. Cost		04 Work	2/20/04 Ovt. Work	\$0 Baseline Work	\$1, Act. Work	034 Rem. W		60	\$1,034
.2.3.6.7	Based ID 8	Assembly Resource Name ElecTechU	Units	Cost \$0	Baseline Cost	0 \$	Rem. Cost	Work 16 h	Ovt. Work 0 h	Baseline Work	Act. Work	Rem. W	Vork 16 h	60	\$1,034
.2.3.6.7	Based ID 8 15	Assembly Resource Name ElecTechU MandS	Units	Cost	Baseline Cost	0 \$	Rem. Cost	Work 16 h	Ovt. Work 0 h	Baseline Work	Act. Work	Rem. W	Vork	60	\$1,034
1.2.3.6.7	ID 8 15 Notes	Assembly Resource Name ElecTechU MandS	Units	Cost \$0	Baseline Cost	0 \$	Rem. Cost	Work 16 h	Ovt. Work 0 h	Baseline Work	Act. Work	Rem. W	Vork 16 h	60	\$1,034
1.2.3.6.7	Based ID 8 15 Notes WBS D	Assembly Resource Name ElecTechU MandS	Units 20% 1,033.6	Cost \$0 \$1,034	Baseline Cost \$ \$	0 \$	Rem. Cost	Work 16 h	Ovt. Work 0 h	Baseline Work	Act. Work	Rem. W	Vork 16 h	60	\$1,034
1.2.3.6.7	Based ID 8 15 Notes WBS D Assem	Assembly Resource Name ElecTechU MandS Definition- bly of the DFEA pro	Units 20% 1,033.6	Cost \$0 \$1,034	Baseline Cost \$ \$	0 \$	Rem. Cost	Work 16 h	Ovt. Work 0 h	Baseline Work	Act. Work	Rem. W	Vork 16 h	60	\$1,034
1.2.3.6.7	ID 8 15 Notes WBS D Assem Labor B	Assembly Resource Name ElecTechU MandS Definition- bly of the DFEA pro	Units 20% 1,033.6 stotype board	Cost \$0 \$1,034 - s at vendo	Baseline Cost \$ \$ r site.	0 \$ 0 \$	Rem. Cost 60 \$0 60 \$1,034	Work 16 h	Ovt. Work 0 h	Baseline Work	Act. Work	Rem. W	Vork 16 h	60	\$1,034
1.2.3.6.7	ID 8 15 Notes WBS D Assem Labor B Based	Assembly Resource Name ElecTechU MandS Definition- bly of the DFEA pro BOE- on Run2a STC - inc	Units 20% 1,033.6 stotype board	Cost \$0 \$1,034 - s at vendo	Baseline Cost \$ \$ r site.	0 \$ 0 \$	Rem. Cost 60 \$0 60 \$1,034	Work 16 h	Ovt. Work 0 h	Baseline Work	Act. Work	Rem. W	Vork 16 h	60	\$1,034
1.2.3.6.7	ID 8 15 Notes WBS D Assem Labor E Based M&S B	Assembly Resource Name ElecTechU MandS Definition- bly of the DFEA pro BOE- on Run2a STC - inc	Units 20% 1,033.6 ototype board	Cost \$0 \$1,034 - s at vendo	Baseline Cost \$ \$ \$ r site.	0 \$ 0 \$	Rem. Cost 00 \$0 00 \$1,034 PCB assembly.	Work 16 h	Ovt. Work 0 h	Baseline Work	Act. Work	Rem. W	Vork 16 h	60	\$1,034
	ID 8 15 Notes WBS D Assem Labor E Based M&S B	Assembly Resource Name ElecTechU MandS Definition- bly of the DFEA pro BOE- on Run2a STC - inc DOE - charges based on the	Units 20% 1,033.6 ototype board	Cost \$0 \$1,034 - s at vendo	Baseline Cost \$ \$ \$ r site.	0 \$ 0 \$	Rem. Cost	Work 16 h 1,033.6	Ovt. Work 0 h	Baseline Work 0 h 0	Act. Work 0 h 0	Rem. W	/ork 16 h 033.6		
	ID 8 15 Notes WBS D Assem Labor E Based M&S B Labor c	Assembly Resource Name ElecTechU MandS Definition- bly of the DFEA pro BOE- on Run2a STC - inc IOE - charges based on the	Units 20% 1,033.6 ototype board cludes collect	Cost \$0 \$1,034 - s at vendo sing the parate of \$40/	Baseline Cost \$ \$ r site. The needed by the site and an overh	0 \$ 0 \$ s s s s s s s s s s s s s s s s	Rem. Cost	Work 16 h 1,033.6	Ovt. Work 0 h	Baseline Work 0 h 0 s	Act. Work 0 h 0	Rem. W 1,	//ork 16 h 033.6	60	
	ID 8 15 Notes WBS D Assem Labor 6 Based	Assembly Resource Name ElecTechU MandS Definition- bly of the DFEA pro BOE- on Run2a STC - inc BOE- charges based on the Test Resource Name	Units 20% 1,033.6 stotype board cludes collect the BU EDF r	Cost \$0 \$1,034 - s at vendo sing the parate of \$40/	Baseline Cost \$ \$ r site. ts needed by the shift and an overh Baseline Cost	0 \$ 0 \$ seed of 61.5% Act. Cost	Rem. Cost 00 \$0 \$1,034 PCB assembly. 2/23/0 Rem. Cost	Work 16 h 1,033.6	Ovt. Work 0 h 4/16/04 Ovt. Work	Baseline Work 0 h 0 80 Baseline Work	Act. Work 0 h 0	Rem. W. 1,	Vork 16 h 033.6		\$1,034 \$10,336
	ID 8 15 Notes WBS D Assem Labor E Based M&S B Labor c	Assembly Resource Name ElecTechU MandS Definition- bly of the DFEA pro BOE- on Run2a STC - inc IOE - charges based on the	Units 20% 1,033.6 ototype board cludes collect	Cost \$0 \$1,034 - s at vendo sing the parate of \$40/	Baseline Cost \$ s r site. ts needed by the shift and an overh Baseline Cost	o s o s ne vendor for ead of 61.5%	Rem. Cost	Work 16 h 1,033.6	Ovt. Work 0 h 4/16/04 Ovt. Work 0 h	Baseline Work 0 h 0 80 Baseline Work	Act. Work 0 h 0 \$10, Act. Work 0 h	Rem. W. 1,	//ork 16 h 033.6		
	ID 8 15 Notes WBS D Assem Labor E Based M&S B Labor C	Assembly Resource Name ElecTechU MandS Definition- bly of the DFEA pro BOE- on Run2a STC - inc BOE- charges based on the Test Resource Name ElecEngU MandS	Units 20% 1,033.6 stotype board cludes collect the BU EDF r Units 50%	Cost \$0 \$1,034 - s at vendo sing the parate of \$40/	Baseline Cost \$ s r site. ts needed by the shift and an overh Baseline Cost	o s o s ne vendor for ead of 61.5%	Rem. Cost S0 \$0 \$1,034	Work 16 h 1,033.6	Ovt. Work 0 h 4/16/04 Ovt. Work 0 h	SO Baseline Work \$0 Baseline Work	Act. Work 0 h 0 \$10, Act. Work 0 h	Rem. W. 1,	Vork 16 h 033.6 \$ Vork 160 h		
1.2.3.6.7	ID 8 15 Notes WBS D Assem Labor 6 Based M&S B Labor 6 ID 4 15 Notes WBS D	ASSEMBLY Resource Name ElecTechU MandS Definition- bly of the DFEA pro BOE- on Run2a STC - inc GOE - charges based on the Test Resource Name ElecEngU MandS	Units 20% 1,033.6 ptotype board cludes collect the BU EDF r Units 50% 10,336	Cost \$0 \$1,034 - s at vendo sing the parate of \$40/	Baseline Cost \$ s r site. rts needed by the shift and an overh Baseline Cost	o s o s ne vendor for ead of 61.5%	Rem. Cost S0 \$0 \$1,034	Work 16 h 1,033.6	Ovt. Work 0 h 4/16/04 Ovt. Work 0 h	SO Baseline Work \$0 Baseline Work	Act. Work 0 h 0 \$10, Act. Work 0 h	Rem. W. 1,	Vork 16 h 033.6 \$ Vork 160 h		
	ID 8 15 Notes WBS D Assem Labor 6 Based M&S B Labor 6 ID 4 15 Notes WBS D	ASSEMBLY Resource Name ElecTechU MandS Definition- bly of the DFEA pro BOE- on Run2a STC - inc COE - charges based on the Test Resource Name ElecEngU MandS	Units 20% 1,033.6 ptotype board cludes collect the BU EDF r Units 50% 10,336	Cost \$0 \$1,034 - s at vendo sing the parate of \$40/	Baseline Cost \$ s r site. rts needed by the shift and an overh Baseline Cost	o s o s ne vendor for ead of 61.5%	Rem. Cost S0 \$0 \$1,034	Work 16 h 1,033.6	Ovt. Work 0 h 4/16/04 Ovt. Work 0 h	SO Baseline Work \$0 Baseline Work	Act. Work 0 h 0 \$10, Act. Work 0 h	Rem. W. 1,	Vork 16 h 033.6 \$ Vork 160 h		

Labor BOE-

Based on Run2a STC - Initial tests took 2 months of a full time physicist for testing the second prototypes of the STC. This included processing several events for a stress test of the system. The engineer was involved half time and worked together with the physicist to certify that we are ready for production. We will follow the same model here, as it worked well for Run2a STC.

.2.3.6.9		Name					Sta		Finish	M&S E			FNAL Labor	Total Cost
		Test					2/23/0	04	4/16/04	\$	0	\$0	\$0	\$0
	ID	Resource Name	Units		Baseline Cost	Act. Cost			Ovt. Work	Baseline Work	Act. Work	Rem. Work	_	
	10	PhysicistU	100%	\$0	\$0	\$0	\$0	320 h	0 h	0 h	0 h	320 h		
	Notes			_										
		Definition- prototype II board to	octing Inclu	doe proces	sing coveral eve	nte for a etroe	s tost							
		system.	esting. Inclu	ues process	sing several eve	1115 IOI & 311C3	3 1631							
	Labor I 8 week	BOE- ks of a university phy	ysicist.											
	M&S B n/a	30E -												
.2.3.6.10		Test at Fermil	ab				3/8/0	04	4/16/04	\$	0	\$0	\$0	\$0
	ID	Resource Name	Units		Baseline Cost	Act. Cost			Ovt. Work	Baseline Work	Act. Work	Rem. Work	_	
	10 Notes	PhysicistU	100%	\$0	\$0	\$0	\$0	240 h	0 h	0 h	0 h	240 h		
	WBS E	Definition-		_	. 0									
		rototypes in special	runs in the r	eai Dzero tr	igger. Stress te	si done by phy	SICIST.							
	Labor I 6 week	BOE- ks of a university phy	ysicist											
	M&S B	BOE-												
	n/a													
.2.3.6.11		Test at Fermil	ab				3/8/0	04	4/16/04	\$	0	\$1,550	\$0	\$1,550
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work					
	4 15	ElecEngU MandS	10% 1,550.4	\$0 \$1,550		50 \$1 50 \$1) h	0 h 0		24 h 50.4	
	Notes		,	, ,			, , , , , ,	,				,		
		Definition-		_										
	Test pr	rototypes in special	runs in the re	eal Dzero tr	igger.									
	Labor I	BOF-												
	This wing person M&S B	ill be a first test of th at FNAL, and a phy	sicist who h	as been inv	olved in the pro	totype testing	The BU engine						tion between engined nd running.	er at FNAL, techni
.2.3.6.12	This winderson M&S B Labor (ill be a first test of th at FNAL, and a phy 3OE-	vsicist who h	as been inv	olved in the pro	totype testing	The BU engine	eer who des		ard will act as a co				er at FNAL, techni
.2.3.6.12	This winderson M&S B Labor (ill be a first test of the at FNAL, and a physico- charges based on the state of th	vsicist who has been seen to have been seen to h	as been inv	olved in the pro	etotype testing tead of 61.5%. Act. Cost	3/8/0	eer who des	signed the boa	ard will act as a co	nsultant to g	\$0 Rem. Work	\$17,880	
.2.3.6.12	This wiperson M&S B Labor (ill be a first test of the at FNAL, and a physic charges based on the second of the se	he BU EDF ab Units	as been invariate of \$40/ Cost \$13,200	hr and an overh	Act. Cost	3/8/0 Rem. Cost \$13,200	04 Work 240 h	4/16/04 Ovt. Work	ard will act as a co \$ Baseline Work 0 h	Act. Work	\$0 Rem. Work h 240	\$17,880	
.2.3.6.12	This wiperson M&S B Labor of	ill be a first test of the at FNAL, and a physico- charges based on the at Fermil Resource Name ElecEngF ElecTechF	vsicist who has been seen to have been seen to h	as been inv	olved in the pro	Act. Cost	3/8/0 Rem. Cost \$13,200	eer who des	4/16/04 Ovt. Work	ard will act as a co \$ Baseline Work 0 h	Act. Work	\$0 Rem. Work h 240	\$17,880	
.2.3.6.12	This wiperson M&S B Labor of ID 3 7 Notes	ill be a first test of the at FNAL, and a physic occupance of the state of the at FNAL, and a physic occupance of the state of the stat	he BU EDF ab Units	as been invariate of \$40/ Cost \$13,200	hr and an overh	Act. Cost	3/8/0 Rem. Cost \$13,200	04 Work 240 h	4/16/04 Ovt. Work	ard will act as a co \$ Baseline Work 0 h	Act. Work	\$0 Rem. Work h 240	\$17,880	
.2.3.6.12	This wiperson M&S B Labor 0 ID 3 7 Notes WBS D	ill be a first test of the at FNAL, and a physico- charges based on the at Fermil Resource Name ElecEngF ElecTechF	whe BU EDF the BU EDF	cost \$13,200 \$4,680	olved in the pro hr and an overh Baseline Cost \$	Act. Cost	3/8/0 Rem. Cost \$13,200	04 Work 240 h	4/16/04 Ovt. Work	ard will act as a co \$ Baseline Work 0 h	Act. Work	\$0 Rem. Work h 240	\$17,880	
.2.3.6.12	This wiperson M&S B Labor C ID 3 7 Notes WBS C Test pr Labor I This wi	ill be a first test of the at FNAL, and a physic occupance of the source Name ElecEngF ElecTechF is obeginned to the source Name in the Source Nam	whe BU EDF is ab Units 100% 50% runs in the re	Cost \$13,200 \$4,680 — eal Dzero tr	olved in the product of the product	Act. Cost	3/8/0 Rem. Cost \$13,200 \$4,680	04 Work 240 h 120 h	4/16/04 Ovt. Work 0 h	s Baseline Work	O Act. Work 0 0	\$0 Rem. Work h 240 h 120	\$17,880	\$17,880
	ID 3 7 Notes WBS E Test pr Labor for	ill be a first test of the at FNAL, and a physic of the at FNAL, and a first test of the at FNAL, and a physical state of the at	whe BU EDF of the BU EDFEA boards	Cost \$13,200 \$4,680 — eal Dzero tr	olved in the product of the product	Act. Cost	3/8/0 Rem. Cost \$13,200 \$4,680	04 Work 240 h 120 h	4/16/04 Ovt. Work 0 h	**Baseline Work O h O h	O Act. Work 0 0	\$0 Rem. Work h 240 h 120	\$17,880	\$17,880
.2.3.6.12	ID 3 7 Notes WBS E Test pr Labor for	ill be a first test of the at FNAL, and a physic of the at FNAL, and a physic of the at FNAL, and a physic of the at Fermil Resource Name ElecEngF ElecTechF: Definition-rototypes in special of the at first test of the property of the at First test of the property of the at FNAL of the at F	whe BU EDF of the BU EDFEA boards	cost \$13,200 \$4,680 — eal Dzero tr	olved in the product of the product	Act. Cost	3/8/0 Rem. Cost \$13,200 \$4,680	04 Work 240 h 120 h	4/16/04 Ovt. Work 0 h 0 h	**Baseline Work O h O h	O Act. Work 0 0 This task hole	\$0 Rem. Work h 240 h 120 ds the FNAL ele	\$17,880	\$17,880

WBS M&S EQ M&S Labor **FNAL Labor** Name Start Finish **Total Cost** "Test at Fermilab " continued WBS Definition-Test prototypes in special runs in the real Dzero trigger. Labor BOE-This will be a first test of the DFEA boards at Fermilab. The DFEA boards will be tested using the modified Run2a DFEA infrastructure. There will be physicist which will be trained on testing the boards using the FNAL test stand. They will be involved in testing the production setup. This task holds the KU physicist labor. 1.2.3.6.14 \$0 Test at Fermilab 3/8/04 4/16/04 \$0 \$0 \$0 Resource Name Units Cost Baseline Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work Act. Cost 10 PhysicistU 100% \$0 \$0 \$0 \$0 240 h 0 h 0 h 240 h Notes WBS Definition-Test prototypes in special runs in the real Dzero trigger Labor BOE-This will be a first test of the DFEA boards at Fermilab. The DFEA boards will be tested using the modified Run2a DFEA infrastructure. There will be physicist which will be trained on testing the boards using the FNAL test stand. They will be involved in testing the production setup. This task holds the ND physicist labor. 1.2.3.6.15 L1 Central Track Trigger DFEA Prototype Tested A 4/16/04 4/16/04 \$0 \$0 \$0 **\$0** Notes WBS Definitionmilestone 1.2.3.7 **DFEA Production** 4/19/04 3/16/05 \$505,296 \$79,996 \$40,100 \$625,392 Notes WBS Definition-This summary task covers the production of the final version of the DFEA's. Risk Mitigation-Cost: There are 3 factors which may affect the "Cost": 1) Xilinx chip prices may not completely follow vendor projected quote. 2) We may need XC2V8000 chips due to equation growth when we put in effects of various inefficiencies and misalignments in the modeling of the CFT in the simulations. 3) The board will use parts which are a factor of 2.5 denser and complicated than the current Run2a DFEA boards. This may lead to higher vendor quotes for PCB fabrication and assembly compared to Run2a quotes included in the BOE. All of these factors may lead to a cost increase which is a significant fraction of project cost. We have address these risks by including a 70% contingency on the XC2V FPGA costs, a 30% contingency on the PCB fabrication, and a 50% contingency on the production parts. 1.2.3.7.1 Procure FPGAs 5/24/04 10/13/04 \$356,000 \$0 \$0 \$356,000 Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Rem. Work 15 MandS 356,000 \$356,000 \$0 \$0 \$356,000 356,000 356.000 Notes WBS Definition-Procure the FPGAs needed for implementing the target algorithm. This is delayed until needed in order to take advantage of price reductions with time. Labor BOEn/a Procure the XC2V FPGAs for all 88 boards (80+8 spares). vendor quote, BOE binder. 1.2.3.7.2 10/13/04 \$0 \$0 Procure FPGAs 5/24/04 \$83,296 \$83,296 Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work 15 MandS 83,296 \$83,296 \$0 \$83,296 83,296 83,296 \$0 Notes WBS Definition-Procure the FPGAs needed for implementing the target algorithm. This is delayed until needed in order to take advantage of price reductions with time.

WBS Name Start Finish M&S EQ M&S Labor **FNAL Labor Total Cost** "Procure FPGAs" continued Notes Labor BOEn/a M&S BOE-Procure the XC2V FPGAs for all 88 boards (80+8 spares). vendor quote, BOE binder. 1.2.3.7.3 9/15/04 \$0 \$0 Procure FPGAs 4/26/04 \$517 \$517 Resource Name Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work ElecTechU \$0 \$0 \$0 \$0 8 h 0 h 0 h 15 MandS 516.8 \$517 \$0 \$0 \$517 516.8 0 516.8 Notes Procure the FPGAs needed for implementing the target algorithm. This is delayed until needed in order to take advantage of price reductions with time. Run2a experience - placing the order and negotiating lead times - same time as spent ordering Run2a STC Xilinc chips. M&S BOE-Labor charges based on the BU EDF rate of \$40/hr and an overhead of 61.5%. 1.2.3.7.21 4/23/04 \$0 \$1,292 \$2,392 Production readiness review 4/19/04 \$1,100 Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work .3 ElecEngF 50% \$1,100 \$0 \$0 \$1,100 20 h 0 h 0 h 0 h 20 h 0 h ElecEngU 50% \$0 \$0 \$0 \$0 20 h 0 h 0 h 20 h 10 **PhysicistU** 100% \$0 \$0 \$0 \$0 40 h 0 h 0 h 0 h 40 h 15 MandS 1,292 \$1,292 \$0 \$0 \$1,292 1,292 0 1,292 Notes Review and sign-off process prior to entering into production of the Digital Front-End Axial boards. 1.2.3.7.4 4/26/04 5/21/04 \$0 \$10.336 \$0 \$10,336 Design, layout Ovt. Work Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Baseline Work Act. Work Rem. Work ElecEngU 50% \$0 \$0 \$0 \$0 80 h 80 h ElecTechU 50% \$0 \$0 \$0 \$0 80 h 0 h 0 h 0 h 80 h \$0 15 10,336 \$10,336 \$0 \$10,336 10,336 10,336 MandS Notes WBS Definition-Make any necessary modifications to prototype II design. Labor charges based on the BU EDF rate of \$40/hr and an overhead of 61.5%. Modification of production layout, checking of all layouts based on Run2a STC experience. It took 4 weeks for the final STC production layout and verification. We use the same estimate here. 1.2.3.7.5 5/24/04 7/6/04 \$0 \$1,550 \$0 \$1,550 Procure production parts Resource Name Units Work Ovt. Work Baseline Work Rem. Work Cost Baseline Cost Act. Cost Rem. Cost Act. Work ElecTechU 8 10% \$0 \$0 \$0 \$0 24 h 0 h 0 h 0 h 24 h 15 MandS 1,550.4 \$1,550 \$0 \$0 \$1,550 1,550.4 1,550.4 Notes WBS Definition-

Labor BOE

Procure the parts for building 88 production DFEA.

BU technical staff will be responsible for procurement of parts and has experience for procuring parts for the Run1a STC.

		Name					Star	t	Finish	M&S EQ	M&S	Labor	FNAL	. Labor	Total Cost
Procure p	roducti	ion parts" contin	ued												
	Notes			_											
	M&S B	OE - charges based on th	ne BU FDF i	ate of \$40/	hr and an overh	ead of 61.5%									
.2.3.7.6		Procure produ	iction part	S			5/24/04	4	7/6/04	\$17,600		\$ 0		\$0	\$17,600
	ID	Resource Name	Units	Cost	Baseline Cost		Rem. Cost	Work	Ovt. Work		Act. Work				
	15	MandS	17,600	\$17,600	3	\$0 \$0	\$17,600	17,600		0		0	17,600		
	Notes WRS D	Definition-		_											
		e the parts for buildir	ng 88 produ	ction DFEA											
	Labor E n/a	BOE-													
	M&S B Cost ba	OE - ased on per board p	rototype par	ts for the S	TC - \$200/board	d. See BOE bir	der.								
.2.3.7.7		PCB Fabricate	9				6/15/04	4	7/27/04	\$0		\$775		\$0	\$775
	ID	Resource Name	Units		Baseline Cost	Act. Cost			vt. Work		ct. Work	Rem. Work			
	8 15	ElecTechU MandS	5% 775.2	\$0 \$775	\$0 \$0	\$0 \$0	\$0 \$775	12 h 775.2	0 h	0 h 0	0 h 0	12 775.			
	Notes														
	_	Definition-		_											
	PCB fa	brication of the DFE	A production	n board.											
	M&S B	on Run2a STC - inc			·		B fabrication.								
2270	Based M&S B	on Run2a STC - inc SOE - charges based on th	ne BU EDF r		·			1	7/27/04	\$20,900		\$ 0		C O	¢30.900
.2.3.7.8	M&S B Labor o	on Run2a STC - inc iOE - charges based on the PCB Fabricate	ne BU EDF r	ate of \$40/	hr and an overh	ead of 61.5%.	6/15/04		7/27/04	\$30,800	Act Work	\$0 Rom	Work	\$0	\$30,800
.2.3.7.8	Based M&S B	on Run2a STC - inc SOE - charges based on th	ne BU EDF r		hr and an overh Baseline Cost	ead of 61.5%.	6/15/04 Rem. Cost	4 Work 30,800	Ovt. Work		Act. Work	Rem.	Work	\$0	\$30,800
.2.3.7.8	Based M&S B Labor c	on Run2a STC - inc OE - charges based on tr PCB Fabricate Resource Name MandS	ne BU EDF r	rate of \$40/	hr and an overh Baseline Cost	ead of 61.5%. Act. Cost	6/15/04 Rem. Cost	Work	Ovt. Work	Baseline Work		Rem.		\$0	\$30,800
.2.3.7.8	M&S B Labor c	on Run2a STC - inc IOE - charges based on the PCB Fabricate Resource Name MandS cefinition-	Units	Cost \$30,800	hr and an overh Baseline Cost	ead of 61.5%. Act. Cost	6/15/04 Rem. Cost	Work	Ovt. Work	Baseline Work		Rem.		\$0	\$30,800
.2.3.7.8	M&S B Labor c	on Run2a STC - inc OE - charges based on the PCB Fabricate Resource Name MandS Definition- shrication of the DFE	Units	Cost \$30,800	hr and an overh Baseline Cost	ead of 61.5%. Act. Cost	6/15/04 Rem. Cost	Work	Ovt. Work	Baseline Work		Rem.		\$0	\$30,800
.2.3.7.8	M&S B Labor of	on Run2a STC - inc OE - charges based on the PCB Fabricate Resource Name MandS Definition- shrication of the DFE	Units	Cost \$30,800	hr and an overh Baseline Cost	ead of 61.5%. Act. Cost	6/15/04 Rem. Cost	Work	Ovt. Work	Baseline Work		Rem.		\$0	\$30,800
.2.3.7.8	M&S B Labor c ID 15 Notes WBS D PCB fa Labor E n/a	on Run2a STC - inc OE - charges based on tr PCB Fabricate Resource Name MandS Definition- abrication of the DFE	Units	Cost \$30,800	hr and an overh Baseline Cost	ead of 61.5%. Act. Cost	6/15/04 Rem. Cost	Work	Ovt. Work	Baseline Work		Rem.		\$0	\$30,800
.2.3.7.8	Based M&S B Labor C ID 15 Notes WBS D PCB fa Labor E n/a M&S B	on Run2a STC - inc OE - charges based on tr PCB Fabricate Resource Name MandS Definition- abrication of the DFE	Units 30,800	Cost \$30,800 n board.	Baseline Cost	ead of 61.5%. Act. Cost 60 \$6	6/15/04 Rem. Cost	Work	Ovt. Work	Baseline Work		Rem.		\$0	\$30,800
.2.3.7.8	Based M&S B Labor C ID 15 Notes WBS D PCB fa Labor E n/a M&S B	on Run2a STC - inc OE - Charges based on tr PCB Fabricate Resource Name MandS Definition- sbrication of the DFE BOE-	Units 30,800	Cost \$30,800 n board.	Baseline Cost	ead of 61.5%. Act. Cost 60 \$6	6/15/04 Rem. Cost	Work 30,800	Ovt. Work	Baseline Work		Rem.		\$0 \$0	\$30,800 \$352
	M&S B Labor of ID 15 Notes WBS D PCB fa Labor E n/a M&S B Based	on Run2a STC - inc OE - charges based on the PCB Fabricate Resource Name MandS Definition- abrication of the DFE BOE- OOE - on Run2a DFEA ver Assembly Resource Name	Units 30,800 EA production units Units	Cost S30,800 n board. see BOE b	Baseline Cost Sinder - \$350/bo Baseline Cost	ead of 61.5%. Act. Cost ard Act. Cost	6/15/04 Rem. Cost 0 \$30,800 7/28/04 Rem. Cost	Work 30,800 4 Work	Ovt. Work 8/24/04 Ovt. Work	S Baseline Work Baseline Work	Act. Work	Rem. 0 \$352 Rem. Wo	30,800		
	Based M&S B Labor c ID 15 Notes WBS D PCB fat Labor E n/a M&S B Based	on Run2a STC - inc OE - Charges based on the PCB Fabricate Resource Name MandS Definition- chrication of the DFE BOE- OOE - on Run2a DFEA ver Assembly Resource Name ElecTechU	Units 30,800 A production units units 30,800	Cost \$30,800 n board. See BOE b	Baseline Cost Saseline Cost Saseline Cost Saseline Cost	ead of 61.5%. - Act. Cost	6/15/04 Rem. Cost 0 \$30,800 7/28/04 Rem. Cost \$0	Work 30,800 4 Work 4.8 h	Ovt. Work 8/24/04	\$0 Baseline Work \$0 Baseline Work	Act. Work 0 h	\$352 Rem. Wo	30,800 ork 4.8 h		
	M&S B Labor of ID 15 Notes WBS C Labor E n/a M&S B Based	on Run2a STC - inc OE - charges based on the PCB Fabricate Resource Name MandS Definition- abrication of the DFE BOE- OOE - on Run2a DFEA ver Assembly Resource Name ElecTechU MandS	Units 30,800 EA production units Units	Cost S30,800 n board. see BOE b	Baseline Cost Sinder - \$350/bo Baseline Cost	ead of 61.5%. Act. Cost ard Act. Cost	6/15/04 Rem. Cost 0 \$30,800 7/28/04 Rem. Cost	Work 30,800 4 Work	Ovt. Work 8/24/04 Ovt. Work	S Baseline Work Baseline Work	Act. Work	\$352 Rem. Wo	30,800		
	ID ID IS Notes WBS D PCB fa Labor E n/a M&S B Based	on Run2a STC - inc OE - charges based on the PCB Fabricate Resource Name MandS Definition- abrication of the DFE BOE- OOE - on Run2a DFEA ver Assembly Resource Name ElecTechU MandS	Units 30,800 EA production units 30,800 Units 37,95	Cost \$30,800 b	Baseline Cost Saseline Cost Saseline Cost Saseline Cost	ead of 61.5%. - Act. Cost	6/15/04 Rem. Cost 0 \$30,800 7/28/04 Rem. Cost \$0	Work 30,800 4 Work 4.8 h	Ovt. Work 8/24/04 Ovt. Work	\$0 Baseline Work \$0 Baseline Work	Act. Work 0 h	\$352 Rem. Wo	30,800 ork 4.8 h		
	ID 15 Notes WBS D PCB fa Labor E n/a M&S B Based ID 8 15 Notes WBS D Assem Labor E Labor E Notes WBS D Assem	on Run2a STC - inc OE - charges based on the PCB Fabricate Resource Name MandS coefinition- shrication of the DFE BOE- OR Run2a DFEA ver Assembly Resource Name ElecTechU MandS coefinition- bly of the DFEA processors	Units 30,800 A production andor quote - Units 3% 351.95	Cost \$30,800 on board. See BOE b Cost \$0 \$352 or ds.	Baseline Cost Sinder - \$350/bo Baseline Cost \$0 \$0	ead of 61.5%. Act. Cost ard Act. Cost \$0 \$0 \$0 \$0	6/15/04 Rem. Cost 0 \$30,800 7/28/04 Rem. Cost \$0 \$352	Work 30,800 4 Work 4.8 h	Ovt. Work 8/24/04 Ovt. Work	\$0 Baseline Work \$0 Baseline Work	Act. Work 0 h	\$352 Rem. Wo	30,800 ork 4.8 h		
	M&S B Labor of 1D 15 Notes WBS D C Labor B n/a M&S B Based 1D 8 15 Notes WBS C Assem Labor B Based	on Run2a STC - inc OE - charges based on the PCB Fabricate Resource Name MandS Definition- abrication of the DFE BOE- OR Run2a DFEA ver Assembly Resource Name ElecTechU MandS Definition- bly of the DFEA proc BOE- on Run2a STC - inc	Units 30,800 A production andor quote - Units 3% 351.95	Cost \$30,800 on board. See BOE b Cost \$0 \$352 or ds.	Baseline Cost Sinder - \$350/bo Baseline Cost \$0 \$0	ead of 61.5%. Act. Cost ard Act. Cost \$0 \$0 \$0 \$0	6/15/04 Rem. Cost 0 \$30,800 7/28/04 Rem. Cost \$0 \$352	Work 30,800 4 Work 4.8 h	Ovt. Work 8/24/04 Ovt. Work	\$0 Baseline Work \$0 Baseline Work	Act. Work 0 h	\$352 Rem. Wo	30,800 ork 4.8 h		
	ID 15 Notes WBS D PCB fa Labor B 15 Notes WBS D PCB fa Labor B 15 Notes WBS D Assem Labor B Based	on Run2a STC - inc OE - charges based on the PCB Fabricate Resource Name MandS Definition- abrication of the DFE BOE- OR Run2a DFEA ver Assembly Resource Name ElecTechU MandS Definition- bly of the DFEA proc BOE- on Run2a STC - inc	Units 30,800 EA production The discrete state of the st	Cost \$30,800 n board. See BOE b Cost \$0 \$352 dds. ting the par	Baseline Cost So So So So State Property of the cost So S	ard Act. Cost SO SO SO Act. Cost From SO 6/15/04 Rem. Cost 0 \$30,800 7/28/04 Rem. Cost \$0 \$352	Work 30,800 4 Work 4.8 h	Ovt. Work 8/24/04 Ovt. Work	\$0 Baseline Work \$0 Baseline Work	Act. Work 0 h	\$352 Rem. Wo	30,800 ork 4.8 h			

WBS		Name					Star	t	Finish	M&S EQ	M&S	Labor	FNAL Labo	or	Total Cost
2.3.7.10		Assembly					7/28/04	1	8/24/04	\$8,800		\$0	\$	0	\$8,800
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Wor			
	15	MandS	8,800	\$8,800	\$0	\$0	\$8,800	8,800		0	0	8,8	800		
	Notes	ofinition		_											
		efinition- bly of the DFEA pro	duction boar	ds.											
	Labor E n/a	BOE-													
	M&S Bo Based o	OE - on Run2a DFE vend	dor quote - s	ee BOE bi	nder - 100\$/boar	d.									
.2.3.7.11		Bench test					8/25/04	1	10/20/04	\$0	\$	15,504	\$	0	\$15,504
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Worl				
	4 15	ElecEngU MandS	75% 15,504	\$0 \$15,504		50 \$0 50 \$0		240 l 15,50			h (0 0	240 h 15,504		
	Notes WBS D	efinition-		_											
		ch production board	d on the test	stand befo	re intallation.										
	M&S Bo Labor c	OE- :harges based on tl	ne BU EDF r	ate of \$40	hr and an overh	ead of 61.5%.									
	Labor E Test 10	BOE-) boards a week. To	be done by	BU EDF e	ngineer in conjur	nction with a ph	nysicist.								
.2.3.7.12		Bench test					8/25/04	ļ	10/20/04	\$0		\$0	\$	0	\$0
	ID	Resource Name	Units		Baseline Cost							Rem. Work	_		
	10	PhysicistU	50%	\$0	\$0	\$0	\$0	160 h	0 h	0 h	0 h	160 h			
	Notes	6 111		_											
		efinition- ich production board	d on the test	stand befo	ore intallation - do	one by physicis	st.								
	Labor E Test 10	BOE- boards a week.													
.2.3.7.13		Test at Fermil	ab				9/9/04	ļ.	3/16/05	\$0	\$	12,920	\$	0	\$12,920
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Worl	k Rem. I	Nork		
	4 15	ElecEngU MandS	20% 12,920	\$0 \$12,920		50 \$0 50 \$0) \$0) \$12,920	200 l 12,920			n (0 h 0	200 h 12,920		
	Notes														
	WBS D	efinition- each board after de	elivery to Fe	- rmilab.											
	WBS D Re-test M&S B	each board after de	-												
	WBS D Re-test M&S B0 Labor c	each board after do OE- charges based on th	-		/hr and an overh	ead of 61.5%.									
	WBS D Re-test M&S B0 Labor c Labor E Testing	each board after de OE- charges based on the BOE- of the DFEA board	ne BU EDF r	ate of \$40	one using the mo	odified Run2a									
	WBS D Re-test M&S BG Labor c Labor E Testing has bee	each board after de OE- charges based on the SOE-	ne BU EDF r	rate of \$40/ ab will be do ing. Alll of t	one using the mo	odified Run2a l will have beer	n trained on the p								
	WBS D Re-test M&S BG Labor c Labor E Testing has bee	each board after do OE- charges based on the BOE- of the DFEA boarden involved in the presentation.	ne BU EDF r ds at Fermila tototype test weeks for re	rate of \$40/ ab will be do ing. Alll of t	one using the mo	odified Run2a l will have beer	n trained on the p	rototype t			te the entire		sing the datapur		
	WBS D Re-test M&S BG Labor C Labor E Testing has bee every d	each board after de OE- charges based on the BOE- of the DFEA board en involved in the properties at Fermil Resource Name	ds at Fermila ototype test weeks for re	ab will be ding. All of the work/retes	one using the mothese personnel st of some of the	odified Run2a will have beer boards if nece	9/9/04 Rem. Cost	orototype t	3/16/05 Ovt. Work	e expect to comple \$0 Baseline Work	te the entire to	\$0 Rem. Worl	sing the datapur	np and be	able to test one b
	WBS D Re-test M&S BO Labor C Labor E Testing has bee every d	each board after do OE- tharges based on the BOE- of the DFEA board ay. This will allow 7 Test at Fermil	ne BU EDF r ds at Fermila tototype test weeks for re	rate of \$40/ ab will be di ing. Alll of t ework/retes	one using the mo these personnel st of some of the	odified Run2a will have beer boards if nece	9/9/04 Rem. Cost	rototype t	3/16/05	e expect to comple	e the entire	test chain us	sing the datapur	np and be	able to test one t

WBS M&S EQ Name Start Finish M&S Labor **FNAL Labor Total Cost**

'Test at Fermilab" continued

Test production boards in special runs in the real Dzero trigger.

Labor BOE-

Done by physicist. Testing of the DFEA boards at Fermilab will be done using the modified Run2a DFEA infrastructure. This setup will be a collaboration between engineer at FNAL, technical person at FNAL, and a physicist who has been involved in the prototype testing. All of these personnel will have been trained on the prototype test phase. We expect to complete the entire test chain using the datapump and be able to test one board every day. This will allow 7 weeks for rework/retest of some of the boards if necessary.

1.2.3.7.15 \$0 Test at Fermilab 9/9/04 3/16/05 \$0 \$0 \$0

Resource Name Units Baseline Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work Cost Act. Cost 10 PhysicistU 100% \$0 \$0 \$0 \$0 1,000 h 0 h 0 h 1.000 h

Notes

WBS Definition-

Test production boards in special runs in the real Dzero trigger.

Labor BOE-

Done by physicist. Testing of the DFEA boards at Fermilab will be done using the modified Run2a DFEA infrastructure. This setup will be a collaboration between enginner at FNAL, technical person at FNAL, and a physicist who has been involved in the prototype testing. all of these personnel will have been trained on the prototype test phase. We expect to complete the entire test chain using the datapump and be able to test one board every day. This will allow 7 weeks for rework/retest of some of the boards if necessary.

1.2.3.7.16 9/9/04 3/16/05 \$0 \$36,750 \$0 \$36.750 Test at Fermilab

ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
- 8	ElecTechU	100%	\$0	\$0	\$0	\$0	1,000 h	0 h	0 h	0 h	1,000 h
10	PhysicistU	100%	\$0	\$0	\$0	\$0	1,000 h	0 h	0 h	0 h	1,000 h
15	MandS	36,750	\$36,750	\$0	\$0	\$36,750	36,750		0	0	36,750

Notes

WBS Definition-

Test production boards in special runs in the real Dzero trigger.

M&S BOE: 25 weeks of Norte Dame engineer at \$3609/wk (including 25% benefits and 48.5% indirect). = \$90,234

Labor BOE-

Done by physicist. Testing of the DFEA boards at Fermilab will be done using the modified Run2a DFEA infrastructure. This setup will be a collaboration between enginner at FNAL, technical person at FNAL. and a physicist who has been involved in the prototype testing, all of these personnel will have been trained on the prototype test phase. We expect to complete the entire test chain using the datapump and be able to test one board every day. This will allow 7 weeks for rework/retest of some of the boards if necessary.

1.2.3.7.17 \$0 Test at Fermilab \$0 3/16/05 \$39,000 \$39,000

Act. Cost Rem. Cost Work Ovt. Work Rem. Work Resource Name Units Cost Baseline Cost Baseline Work Act. Work 100% \$39,000 1,000 h ElecTechF \$0 \$0 \$39,000 0 h0 h 0 h 1.000 h \$0 \$0 **PhysicistF** 50% \$0 \$0 500 h 0 h 0 h 0 h 500 h

WBS Definition-

Test production boards in special runs in the real Dzero trigger.

Done by physicist. Testing of the DFEA boards at Fermilab will be done using the modified Run2a DFEA infrastructure. This setup will be a collaboration between enginner at FNAL, technical person at FNAL, and a physicist who has been involved in the prototype testing, all of these personnel will have been trained on the prototype test phase. We expect to complete the entire test chain using the datapump and be

able to test one board every day. This will allow 7 weeks for rework/retest of some of the boards if necessary.

1.2.3.7.18		Board rework					9/9/0)4	3/16/05	\$8,800		\$0	\$0	\$8,800
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	10	PhysicistU	100%	\$0	\$0	\$0	\$0	1,000 h	0 h	0 h	0 h	1,000 h	_	
	15	MandS	8 800	¢8 800	\$0	0.2	\$8.800	8 800		0	0	8 800		

Notes

WBS Definition-

Rework of FPGA assemblies on DFEA boards

M&S BOE-

	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost
Board rew	work" continued						
	Notes Testing of the DFEA boards at Fermilab will be done using the modified Run2i project will have 4 times more FPGAs on the board. Therefore we allocate an a	a DFEA infrastructure. Vaverage \$100 per board	Ve had several prob for PFGA rework ba	lems with FPGA cont ased on vendor quote	acts on the Run2a S for Run2a board re	STC boards and this new	eeded rework. This inder.
2.3.7.19	L1 Central Track Trigger Production And Testing C	3/16/05	3/16/05	\$0	\$0	\$0	\$0
	Notes WBS Definition- milestone: track trigger complete except for installation and commissioning						
2.3.7.20	L1 Trigger Upgrade Production and Testing Compl	3/16/05	3/16/05	\$0	\$0	\$0	\$0
	WBS Definition- milestone: All Level 1 trigger upgrade systems produced and tested.						
2.4	Level 2 Beta Processor	12/1/03	2/28/05	\$48,950	\$44,466	\$0	\$93,416
	WBS Definition- This summary element includes the procurement of additional single-board cor	mputers (Level 2 Beta pr	ocessors), associate	ed hardware, and firm	ware support.		
2.4.1	Finalize Targets For Run2b Beta Upgrades Notes	12/1/03	9/13/04	\$0	\$0	\$0	\$0
	WBS Definition- Find appropriate upgrade processor boards for L2Beta system and determine and also any hardware incompatibilities that may have to be addressed. The hardware incompatibilities that may have to be addressed.						d firmware implicat
2.4.1.1	Assess Performance of Run2a Betas	12/1/03	2/4/04	\$0	\$0	\$0	\$0
	ID Resource Name Units Cost Baseline Cost Act. Cost 10 PhysicistU 25% \$0 \$0 \$0	Rem. Cost Work \$0 80 h	Ovt. Work Bas	seline Work Act. W	ork Rem. Work 0 h 80 h	_	
	, , , , , , , , , , , , , , , , , , , ,	\$0 60 H	011	011	011 0011		
	Notes WBS Definition-			<i>0.1.</i>	011 0011		
	Notes	atest need for increased	processing power.				grades on this
	Notes WBS Definition- Evauate performance of L2Beta processors in Run2a. Determine areas of gre Labor BOE- Compile data on overall performance of L2Betas in Run2a. Rejection factors v	atest need for increased	processing power.				grades on this
2.4.1.2	Notes WBS Definition- Evauate performance of L2Beta processors in Run2a. Determine areas of gre Labor BOE- Compile data on overall performance of L2Betas in Run2a. Rejection factors we performance. M&S BOE-	atest need for increased	processing power.				grades on this
.2.4.1.2	Notes WBS Definition- Evauate performance of L2Beta processors in Run2a. Determine areas of gre Labor BOE- Compile data on overall performance of L2Betas in Run2a. Rejection factors of performance. M&S BOE- n/a Assess Performance of Run2a Betas ID Resource Name Units Cost Baseline Cost Act. Cost	atest need for increased /s. Luminosity, efficiencie 12/1/03 Rem. Cost Work	processing power. es measured from da 2/4/04 Ovt. Work Ba	ata, etc. Estimate imp \$0 seline Work Act. W	pact of Run2b lumin \$0 Vork Rem. Work	osity and hardware up	
.2.4.1.2	Notes WBS Definition- Evauate performance of L2Beta processors in Run2a. Determine areas of gre Labor BOE- Compile data on overall performance of L2Betas in Run2a. Rejection factors of performance. M&S BOE- n/a Assess Performance of Run2a Betas	atest need for increased rs. Luminosity, efficiencie	processing power. es measured from da 2/4/04	ata, etc. Estimate imp	pact of Run2b lumin	osity and hardware up	
.2.4.1.2	Notes WBS Definition- Evauate performance of L2Beta processors in Run2a. Determine areas of gre Labor BOE- Compile data on overall performance of L2Betas in Run2a. Rejection factors of performance. M&S BOE- n/a Assess Performance of Run2a Betas ID Resource Name Units Cost Baseline Cost Act. Cost 10 PhysicistU 200% \$0 \$0 \$0 Notes WBS Definition-	atest need for increased vs. Luminosity, efficiencie 12/1/03 Rem. Cost Work \$0 640 h	processing power. es measured from da 2/4/04 Ovt. Work Ba 0 h	ata, etc. Estimate imp \$0 seline Work Act. W	pact of Run2b lumin \$0 Vork Rem. Work	osity and hardware up	
.2.4.1.2	Notes WBS Definition- Evauate performance of L2Beta processors in Run2a. Determine areas of gre Labor BOE- Compile data on overall performance of L2Betas in Run2a. Rejection factors we performance. M&S BOE- n/a Assess Performance of Run2a Betas ID Resource Name Units Cost Baseline Cost Act. Cost 10 PhysicistU 200% \$0 \$0 \$0 Notes WBS Definition- Evauate performance of L2Beta processors in Run2a. Determine areas of gre	atest need for increased vs. Luminosity, efficiencie 12/1/03 Rem. Cost Work \$0 640 h	processing power. es measured from da 2/4/04 Ovt. Work Ba 0 h	ata, etc. Estimate imp \$0 seline Work Act. W	pact of Run2b lumin \$0 Vork Rem. Work	osity and hardware up	
.2.4.1.2	Notes WBS Definition- Evauate performance of L2Beta processors in Run2a. Determine areas of gre Labor BOE- Compile data on overall performance of L2Betas in Run2a. Rejection factors of performance. M&S BOE- n/a Assess Performance of Run2a Betas ID Resource Name Units Cost Baseline Cost Act. Cost 10 PhysicistU 200% \$0 \$0 \$0 Notes WBS Definition-	atest need for increased rs. Luminosity, efficiencia rs. L	processing power. es measured from da 2/4/04 Ovt. Work Ba 0 h processing power.	\$0 Seline Work Act. W	\$0 Vork Rem. Work 0 h 640	osity and hardware up	\$0
.2.4.1.2	Notes WBS Definition- Evauate performance of L2Beta processors in Run2a. Determine areas of gre Labor BOE- Compile data on overall performance of L2Betas in Run2a. Rejection factors of performance. M&S BOE- n/a Assess Performance of Run2a Betas ID Resource Name Units Cost Baseline Cost Act. Cost 10 PhysicistU 200% \$0 \$0 \$0 Notes WBS Definition- Evauate performance of L2Beta processors in Run2a. Determine areas of gre Labor BOE- Compile data on overall performance of L2Betas in Run2a. Rejection factors of the second control of the second co	atest need for increased rs. Luminosity, efficiencia rs. L	processing power. es measured from da 2/4/04 Ovt. Work Ba 0 h processing power.	\$0 Seline Work Act. W	\$0 Vork Rem. Work 0 h 640	osity and hardware up	\$0
1.2.4.1.2	Notes WBS Definition- Evauate performance of L2Beta processors in Run2a. Determine areas of gre Labor BOE- Compile data on overall performance of L2Betas in Run2a. Rejection factors of performance. M&S BOE- n/a Assess Performance of Run2a Betas ID Resource Name Units Cost Baseline Cost Act. Cost 10 PhysicistU 200% \$0 \$0 \$0 Notes WBS Definition- Evauate performance of L2Beta processors in Run2a. Determine areas of gre Labor BOE- Compile data on overall performance of L2Betas in Run2a. Rejection factors of performance. M&S BOE-	atest need for increased rs. Luminosity, efficiencia rs. L	processing power. es measured from de 2/4/04 Ovt. Work Ba O h processing power. es measured from de 9/3/04	\$0 Seline Work Act. Work ata, etc. Estimate imp	\$0 Vork Rem. Work 0 h 640	s0 h solity and hardware up	\$0

NBS	Name	Start	Finish	M&S EQ M	&S Labor	FNAL Labor	Total Cost
Develop &	Simulate New Run2b Algortihms" continued						
	Notes						
	WBS Definition- Develop Run2b algorithms for the Beta processors.						
	Labor BOE- With trigger simulations of upgraded L1 systems and L2STT, develop trigger algo	rithme nococcary doliv	or nococcary ro	signation at L2 for Pun2h Maa	suro algorithm ti	ming in simulator to d	lotormina CDLI
	requirements for each L2 subsystem.	illillis necessary deliv	er necessary re	ejection at L2 for Run2b. Mea	sure algorithm to	ining in simulator to d	leterning CFO
	MODOE						
	M&S BOE- n/a						
0 4 4 4	Davidar 9 Circulate Navi Direch Alexatibres	2/5/04	0/0/04	ФО.		# 0	
2.4.1.4	Develop & Simulate New Run2b Algorithms		9/3/04	\$0	\$0	\$0	\$0
	ID Resource Name Units Cost Baseline Cost Act. Cost F 10 PhysicistU 100% \$0 \$0 \$0	Rem. Cost Work \$0 1,200 h	Ovt. Work 0 h	Baseline Work Act. Work 0 h 0	Rem. Work h 1,200 l	h	
	Notes	, , , ,			,		
	WBS Definition-						
	Develop Run2b algorithms for the Beta processors.						
	Labor BOE-						
	With trigger simulations of upgraded L1 systems and L2STT, develop trigger algo	rithms necessary deliv	er necessary re	ejection at L2 for Run2b. Mea	sure algorithm ti	ming in simulator to d	leterming CPU
	requirements for each L2 subsystem.						
	M&S BOE-						
	n/a						
2.4.1.5	Develop & Simulate New Run2b Algortihms	2/5/04	9/3/04	\$0	\$0	\$0	\$0
		Rem. Cost Work	Ovt. Work	Baseline Work Act. Work	Rem. Work	40	ų v
	10 PhysicistU 400% \$0 \$0 \$0	\$0 4,800 h		0 h 0		h	
	Notes						
	WBS Definition-						
	Develop Run2b algorithms for the Beta processors.						
	Labor BOE-						
	With trigger simulations of upgraded L1 systems and L2STT, develop trigger algo requirements for each L2 subsystem.	rithms necessary deliv	er necessary re	ejection at L2 for Run2b. Mea	sure algorithm ti	ming in simulator to d	leterming CPU
	requirements for each L2 subsystem.						
	M&S BOE-						
	n/a						
2.4.1.6	Production readiness review	9/7/04	9/13/04	\$0	\$0	\$0	\$0
		Rem. Cost Work	Ovt. Work	Baseline Work Act. Work	Rem. Work	_	
	10 PhysicistU 200% \$0 \$0 \$0	\$0 80 h	0 h	0 h 0 h	80 h		
	Notes WBS Definition-						
	All components needed to test the prototype Beta are acquired and working.						
2.4.2	Develop Prototype	3/18/04	8/6/04	\$8,610	\$24,123	\$0	\$32,733
	Notes WBS Definition-						
	Find appropriate upgrade processor boards for L2Beta system and determine any	necessary changes to	the system to f	unction wiht the new boards.	This includes a	study of software and	d firmware implication
	and also any hardware incompatibilities that may have to be addressed. The hard	ware issues would be	limited to hard d	lisk connections that differ bet	ween manufactu	urers.	·
2.4.2.1	Survey processor market, chose candidate SBCs	3/18/04	4/14/04	\$0	\$0	\$0	\$0
		Rem. Cost Work		Baseline Work Act. Work	Rem. Work	Ŧ-	70
	10 PhysicistU 25% \$0 \$0 \$0	\$0 40 h	0 h	0 h 0 h	40 h	-	
	Notes						
	WBS Definition-						

WBS M&S EQ M&S Labor **FNAL Labor Total Cost** Name Start Finish "Survey processor market, chose candidate SBCs" continued Start search for upgraded processors. Compare cPCI processors on market for compatibility and performance in L2Beta motherboards. Experience w/ original Beta processors. Survey cPCI board manufactures, request literature and price quotes, and compare specifications of boards. M&S BOEn/a 1.2.4.2.2 Evaluate software impact of new SBCs 3/18/04 4/14/04 \$0 \$0 \$0 \$0 Resource Name Units Work Ovt. Work Act. Work Rem. Work 10 PhysicistU \$0 \$0 \$0 \$0 40 h 0 h 0 h 0 h 40 h Notes WBS Definition-Determine if newer boards require changes to existing code. Experience w/ design/development of hardware driver code for Run2a Alpha and Beta processors. M&S BOEn/a 1.2.4.2.3 Evaluate firmware impact of new SBCs (function) 3/18/04 4/14/04 \$0 \$0 \$0 \$0 Resource Name Units Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work 10 PhysicistU 25% \$0 \$0 \$0 \$0 40 h 0 h 0 h 0 h 40 h Notes Determine extent of any necessary firmware changes to use new board and/or upgrade system performance. The only changes forseen are limited to interrupt generation firmware. Labor BOF-This task is equivalent to a small module included in the Run2a Beta firmware. Most of the technical issues should be uncovered in the market survey. Any proposed changes would then be disscussed with all L2 software experts. M&S BOE-Experience w/ original Beta processors. This task is equivalent to a small module included in the Run2a Beta firmware. 1.2.4.2.4 \$0 \$0 Evaluate firmware impact of new SBCs (coding) 3/18/04 4/14/04 \$8.247 \$8.247 ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work **ElecEngU** 50% 80 h \$0 \$0 \$0 \$0 0 h 0 h 0 h 80 h \$8,247 \$0 15 MandS 8,247.2 \$0 \$8,247 8,247.2 0 8,247.2 Notes Determine extent of any necessary firmware changes to use new board and/or upgrade system performance. The only changes forseen are limited to interrupt generation firmware. In the Run2a beta project we typically have had 1 week turnaround on firmware changes involving protocol changes between our 9U board and the SBC. A recent project of similar scale involved changing of ouput buffering in internal FIFOs of our FPGA and completion simulation studies. New interrupt logic would require full simulation in order to check interactions with our internal state machines. Our project allows time for studies of two designs. M&S BOE-Experience w/ original Beta processors. This task is equivalent to a small module included in the Run2a Beta firmware. 7/9/04 \$8,160 \$0 \$0 1.2.4.2.5 Acquire 2 new processor SBCs for evaluation 4/15/04 \$8,160 Resource Name Baseline Work Units Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Act. Work Rem. Work 10 PhysicistU 5% 24 h 24 h \$0 \$0 \$0 \$0 0 h 0 h 0 h 15 MandS 8.160 \$8.160 \$0 \$0 0 8.160 \$8.160 8.160 Notes WBS Definition-

WBS M&S EQ M&S Labor **FNAL Labor Total Cost** Name Start Finish "Acquire 2 new processor SBCs for evaluation" continued Acquire cPCI boards for software/firmware tests of upraded L2Beta system. Experience w/ original Beta processors. Order lead times varied amoung manufacturers from 2-12 weeks. Estimated from vendor quotes (prices range 30% across manufacturers due to differences in both base prices and available configurations). Quotes from Advantec and VMIC are included in the project documentation. 1.2.4.2.6 Design Disk adapter 4/15/04 5/12/04 \$0 \$4,124 \$0 \$4,124 Act. Work Rem. Work ID Resource Name Work Ovt. Work Baseline Work Units Cost Act. Cost Rem. Cost Baseline Cost ElecEngU 25% \$0 \$0 40 h 0 h 40 h 4 \$0 \$0 0 h0 h 15 MandS 4,123.6 \$4,124 \$0 \$0 \$4,124 4,123.6 0 0 4,123.6 Notes WBS DefinitioncPCI manufacturers have no uniform standards for i/o pins, not specified by the cPCI specification. The new SBC choosen for the Betas may require a small passive adapter card to attach to the hard drive. Space and Mechanical constraints must be addressed for the adapter design. Similar issues were addresses in the design of the 9U motherboard for the Run2a Beta project. Contingency estimate based on guidance for tasks w/o existing conceptual design. M&S BOEn/a 1.2.4.2.7 Specify/Acquire adapter components 5/13/04 6/10/04 \$200 \$825 \$0 \$1.025 ID Resource Name Units Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work Baseline Cost 4 ElecEnaU 5% \$0 \$0 \$0 \$0 8 h 0 h 0h8 h 0 h 15 MandS 1,024.72 \$1,025 \$0 \$0 \$1,025 1,024.72 0 0 1,024.72 Notes WBS Definition-Choose and purchase components for disk adapters: hard metric connectors, headers, cables. Labor BOE-Labor is limited to placing 1-2 online of telephone orders. Catalog pricing for connectors, cables. See catalog pricing from Newark in attached documentation for cost of major components. 12 boards + 10% spare parts ~ \$200. Contingency based on guidance for quotations. 1.2.4.2.8 \$0 \$0 Layout adapter, generate artwork, etc 6/11/04 6/24/04 \$8.247 \$8.247 ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work ElecEngU 100% \$0 \$0 \$0 \$0 \$0 80 h 0 h 0 h 0 h 80 h 15 \$0 MandS 8,247.2 \$8,247 \$8,247 8,247.2 0 0 8,247.2 Notes WBS Definition-Generate artwork for the disk adapter. Labor BOE-The disk adapter design requires a small (~3inch by 1 inch) pcb w/ a hard metric connector, a 40pin header and 40 traces routed. The board would be passive and include 2 or 4 signal layers. Space and Mechanical constraints must be addressed for the adapter design. The estimate is base on 3 days electrical design and mechanical design. 2 days in house mechanical prototyping. 1 day layout. 1 day finialize artwork and review. (Layout Engineers + EE + Mech. staff may all be involved). Contingency estimate based on guidance for tasks w/o existing conceptual design. M&S BOE-

n/a

		Name					Sta		Finish	M&S EC		S Labor	FNAL	Labor	Total Cost
2.4.2.9		Find manufact	turer for di	sk adap	ters		6/25/0)4	7/9/04	\$0)	\$2,062		\$0	\$2,062
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost		Work	Ovt. Work	Baseline Work			Work		
	4 15	ElecEngU MandS	25% 2,061.8	\$0 \$2,062			50 \$0 50 \$2,062	20 h 2,061.8			h 0	0 h 0	20 h 2,061.8		
	Notes	manao	2,007.0	02,002	•		,,,,,,,	2,007.0			•		2,007.0		
		efinition-		_											
		nanufacturer for the	disk adapte	ers.											
	Labor E Contrac M&S B	ting the production	of a small 2	to 4 layer	PCB from a loca	al manufacture	er. 1 day for coll	ecting quote	s + 1.5 day fo	or internal paperwo	ork, transmitt	ng artwork,	etc.		
	n/a														
2.4.2.10		Produce proto	type adap	ters			7/12/0)4	7/30/04	\$250)	\$619		\$0	\$869
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. W	ork	**	,,,,
	4	ElecEngU	5%	\$0	\$0	\$0	\$0	6 h	0 h	0 h	0 h		6 h		
	15	MandS	868.54	\$869	\$0	\$0	\$869	868.54		0	C	86	88.54		
	Notes	6		_											
		efinition- e 2 prototype disk a	dapters												
	Labor E	BOE-													
		s limited to coordina	ting manufac	cture w/ P	CB company. Cl	hecking on pr	oduction status,	visual inspe	ction of board	ds.					
	M&S B	Դ Ε₋													
		of Quotes from onlin	ne survey (In	cluded in	attached docume	entation for Po	CB Express); 2 b	oards less t	han 9 square	inches = \$250					
2.4.2.11		Tost prototype	adantera				8/2/0	24	8/6/04	\$(`	\$0		\$0	\$0
2.4.2.11		Test prototype	•							•				ΦU	ΦC
	1D 10	Resource Name PhysicistU	Units 25%	Cost \$0	Baseline Cost \$0	Act. Cost \$0	Rem. Cost \$0	Nork Ov 10 h	rt. Work B 0 h	Baseline Work A 0 h	lct. Work 0 h	Rem. Work	h		
	Notes	1 Hydioloto	2070	Ψ0	40	\$ 0	40	1011	011	011	0 11	70	,,		
	Motes														
		efinition-		_											
	WBS D	efinition- ototype disk adapter	rs.	_											
	WBS D Test pr	ototype disk adapter	rs.	_											
	WBS D Test pro	ototype disk adapter 30E-		- hoards F	Plug it in and see	if it works! If	not check conne	octions (agai	n) renair and	reneat					
	WBS D Test pro	ototype disk adapter		_ boards. F	Plug it in and see	if it works! If	not check conne	ections (agai	n), repair and	repeat.					
	WBS D Test pro Labor E Based	ototype disk adapter BOE- on experience with F		boards. F	Plug it in and see	if it works! If	not check conne	ections (agai	n), repair and	repeat.					
	WBS D Test pro Labor E Based	ototype disk adapter BOE- on experience with F		boards. F	Plug it in and see	if it works! If	not check conne	ections (agai	n), repair and	repeat.					
.2.4.2.12	WBS D Test pro Labor E Based	ototype disk adapter BOE- on experience with F OE-	Run2a Beta I				not check conne		n), repair and	repeat.)	\$0		\$0	\$0
.2.4.2.12	WBS D Test pro Labor E Based	ototype disk adapter BOE- on experience with F	Run2a Beta I)	\$0		\$0	\$0
2.4.2.12	WBS D Test pro Labor E Based M&S Bon/a	cototype disk adapter BOE- DE- Level 2 Beta efinition-	Run2a Beta I	rototyp	e Preparation	n Comple	8/6/0)	\$0		\$0	\$0
.2.4.2.12	WBS D Test pro Labor E Based M&S Bon/a	ototype disk adapter 3OE- on experience with F OE- Level 2 Beta	Run2a Beta I	rototyp	e Preparation	n Comple	8/6/0)	\$0		\$0	\$0
	WBS D Test pro Labor E Based M&S Bon/a	ototype disk adapter SOE- on experience with F OE- Level 2 Beta efinition- ne: All components	Run2a Beta l Trigger Properties of the second seco	rototyp	e Preparation	n Comple	8/6/0 working.	04	8/6/04	\$(
2.4.2.12	WBS D Test pn Labor E Based M&S B n/a Notes WBS D milesto	cototype disk adapter BOE- DE- Level 2 Beta efinition-	Run2a Beta l Trigger Properties of the second seco	rototyp	e Preparation	n Comple	8/6/0	04				\$0		\$0	
	WBS D Test pro Labor E Based M&S B n/a Notes WBS D milesto	totype disk adapter SOE- on experience with F OE- Level 2 Beta efinition- ne: All components Test Prototyp	Run2a Beta l Trigger Properties of the second seco	rototyp	e Preparation	n Comple	8/6/0 working.	04	8/6/04	\$(
	WBS D Test pro Labor E Based M&S B n/a Notes WBS D milesto	ototype disk adapter SOE- on experience with F OE- Level 2 Beta efinition- ne: All components	Trigger Proneeded to te	rototyp - est the pro	e Preparation totype Beta are a	n Comple	8/6/0 working.	04	8/6/04	\$(
2.4.3	WBS D Test pro Labor E Based M&S B n/a Notes WBS D milesto	cototype disk adapter SOE- on experience with FOE- Level 2 Beta effinition- ne: All components Test Prototyp efinition- peration of cPCI bo	Trigger Properties of the second seco	rototyp - est the pro - Beta 9U n	e Preparation totype Beta are a notherboards.	n Comple acquired and	8/6/0 working. 8/9/0	04	8/6/04	\$() \$	19,793		\$0	\$19,793
2.4.3	WBS D Test pro Labor E Based of M&S B n/a Notes WBS D milesto	cototype disk adapter BOE- DE- Level 2 Beta efinition- ne: All components Test Prototyp efinition- peration of cPCI bo Verify software	Trigger Properties of the compatition of the compat	rototyp - est the pro - Beta 9U n	e Preparation totype Beta are a	n Comple	8/6/0 working. 8/9/0	04	8/6/04 11/1/04 10/4/04	\$(\$() \$	19,793			\$19,793
2.4.3	WBS D Test pro Labor E Based of M&S B n/a Notes WBS D milesto Notes WBS D Verify c	cototype disk adapter SOE- on experience with FOE- Level 2 Beta effinition- ne: All components Test Prototyp efinition- peration of cPCI bo Verify software Resource Name	Trigger Poneeded to tee	rototyp - est the pro - Beta 9U n Diity / ha	e Preparation totype Beta are a notherboards. ardware interf	n Comple acquired and	8/6/0 working. 8/9/0 8/9/0 Rem. Cost	04 04 Work Ov	8/6/04 11/1/04 10/4/04 t. Work B	\$(\$(\$() \$() \$aseline Work)) lot. Work	19,793 \$0 Rem. Work	h -	\$0	\$19,793
	WBS D Test pro Labor E Based of M&S B n/a Notes WBS D milesto	cototype disk adapter BOE- DE- Level 2 Beta efinition- ne: All components Test Prototyp efinition- peration of cPCI bo Verify software	Trigger Properties of the compatition of the compat	rototyp - est the pro - Beta 9U n	e Preparation totype Beta are a	n Comple	8/6/0 working. 8/9/0	04	8/6/04 11/1/04 10/4/04	\$(\$() \$	19,793	h	\$0	\$19,793 \$19,60

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VBS		Name						Start	Fini	sh	M&S EQ	M&S	Labor	FNAL La	abor	Total Cost
Verify so	ftware c	compatibiity / ha	ardware int	erface pa	atches" con	tinued										
	Notes	205		=												
	Labor E	BOE- ence w/ original Beta	a processors	- make an	v necessarv ch	nages to cor	npile cod	e on new boa	rds or to access	new register	rs.					
	•	· ·			,,											
	M&S B	OE-														
	1174															
.2.4.3.2		Firmware sup	port and tu	ıning				8/9/04	10/4/	04	\$0	\$	19,793		\$0	\$19,793
	ID	Resource Name	Units	Cost	Baseline		Cost	Rem. Cost	Work	Ovt. Work	Baseline Wor		. Work	Rem. Work	_	
	4 15	ElecEngU MandS	60% 19,793.28		\$0 93	\$0 \$0	\$0 \$0	\$0 \$19,793	192 h 19,793.28	0 h	'	0 h 0	0 h 0	192 h 19,793.28		
	Notes															
	WBS D	efinition-		_												
	Develo	p any necessary (or	desired) firm	ware enha	imcements.											
	Labor E	BOE-														
	We allo	ot time for approxima	ately 4 mode	rate firmwa	re changes wi	th full simulat	ion stutie	s. (1 week e	ach, same as es	timate in 1.2	2.4.2.4)					
	M&S B	OE-														
	n/a															
.2.4.3.3		Verify process	or onerah	ility in Be	ta motherh	nards		8/9/04	10/4/	N 4	\$0		\$0		\$0	\$0
.2.1.0.0	ID	Resource Name	•	•	aseline Cost	Act. Cost	Rem. C			Baseline I		Vork	Rem. Work		ΨΟ	ΨΟ
	10	PhysicistU	60%	\$0	\$0	\$0	rtom. c	\$0 192			0 h	0 h	192			
	Notes															
	WBS D	efinition-		-												
	WBS D	efinition- n assembled card ur	nder typical I/	- O condition	ns.											
	WBS D Test an	n assembled card ur BOE-	7.		ns.											
	WBS D Test an	assembled card ur	7.		ns.											
	WBS D Test an	n assembled card ur BOE- te from experience v	7.		ns.											
	WBS D Test an Labor E Estimat	n assembled card ur BOE- te from experience v	7.		ns.											
2.4.3.4	WBS D Test an Labor E Estimat	n assembled card ur BOE- te from experience v	with Run2a B		ns.			10/5/04	11/1/	04	\$0		\$0		\$0	\$0
.2.4.3.4	WBS D Test an Labor E Estimat M&S B n/a	n assembled card un BOE- te from experience v OE- Shadow mode	with Run2a B		ns.			10/5/04	11/1/	04	\$0		\$0		\$0	\$0
.2.4.3.4	WBS D Test an Labor E Estimat M&S B n/a Notes WBS D	n assembled card un BOE- te from experience v OE- Shadow mode	with Run2a B	etas.						04	\$0		\$0		\$0	\$0
.2.4.3.4	WBS D Test an Labor E Estimat M&S B n/a Notes WBS D	n assembled card un BOE- te from experience v OE- Shadow mode	with Run2a B	etas.		's in 'shadow'	mode wł			04	\$0		\$0		\$0	\$0
.2.4.3.4	WBS D Test an Labor E Estimat M&S B n/a Notes WBS D	n assembled card un BOE- te from experience v OE- Shadow mode	with Run2a B e studies al prototype s	etas. - tudies and	algorithm test		mode wh				\$0 \$0		\$0 \$0		\$0 \$0	\$0 \$0
	WBS D Test and Labor E Estimal M&S B n/a Notes WBS D Time re	a assembled card una some card	with Run2a B e studies al prototype s	etas. - tudies and	algorithm test		mode wh	nile experime	nt is running.							,
	WBS D Test and Labor E Estimal M&S B n/a Notes WBS D Time re	n assembled card un BOE- te from experience von OE- Shadow mode Definition- Served for additional Level 2 Beta	e studies al prototype s	etas. - studies and rototype	algorithm test Testing Co	omplete	mode wł	nile experime	nt is running.							,
	WBS D Test and Labor E Estimal M&S B n/a Notes WBS D Time re	a assembled card una some card	e studies al prototype s	etas. - studies and rototype	algorithm test Testing Co	omplete	mode wł	nile experime	nt is running.							,
.2.4.3.5	WBS D Test and Labor E Estimal M&S B n/a Notes WBS D Time re	a assembled card una some content of the from experience of the from	with Run2a Be studies al prototype s Trigger Poseta meets fu	etas tudies and rototype - nctional i/o	algorithm test Testing Co	omplete	mode wł	nile experime	nt is running.	04						,
.2.4.3.5	WBS D Test and Labor E Estimate M&S B n/a Notes WBS D Time re Notes WBS D milesto	a assembled card una some assembled card una some assembled card una some assemble processor and assemble processor as a processor	with Run2a Be studies al prototype s Trigger Poseta meets fu	etas tudies and rototype - nctional i/o	algorithm test Testing Co	omplete	mode wh	nile experime	nt is running. 11/1 /	04	\$0		\$0		\$0	\$0
.2.4.3.5	WBS D Test and Labor E Estimal M&S B n/a Notes WBS D Time re Notes WBS D milesto	sassembled card una some some service of some	e studies al prototype s Trigger Pi seta meets fu	etas tudies and rototype - nctional i/o	algorithm test Testing Co	omplete	mode wh	nile experime	nt is running. 11/1 /	04	\$0		\$0		\$0	\$0
	WBS D Test and Labor E Estimal M&S B n/a Notes WBS D Time re Notes WBS D milesto	a assembled card una some assembled card una some assembled card una some assemble processor and assemble processor as a processor	e studies al prototype s Trigger Pi seta meets fu	etas tudies and rototype - nctional i/o	algorithm test Testing Co	omplete	mode wh	nile experime	nt is running. 11/1 /	04	\$0		\$0		\$0	\$0
.2.4.3.5	WBS D Test and Labor E Estimal M&S B n/a Notes WBS D Time re Notes WBS D milesto	sassembled card una some some service of some	e studies al prototype s Trigger Pi deta meets fu oduction essors	etas tudies and rototype - nctional i/o	algorithm test Testing Co	omplete	mode wł	nile experime	nt is running. 11/1 /	04	\$0		\$0		\$0	\$0
.2.4.3.5	WBS D Test and Labor E Estimati M&S Bin/a Notes WBS D Time re Notes WBS D Milesto Notes WBS D Assemi	a assembled card una company assembled card una company assembled card una company assemble production assemble produce Disk Resource Name	e studies e studies al prototype s Trigger Pl deta meets fu oduction essors Adapters Units	etas.	algorithm test Testing Co requirements ors	Act. Cost	Rem	11/1/04 10/5/04 10/5/04 0. Cost W	11/1/ 2/28/ 10/25/ ork Ovt. Wol	04 05 04 k Baselir	\$0 \$40,340 \$500 ne Work Ac	t. Work	\$0 \$550 \$550 Rem. Wo		\$0	\$0 \$40,890
2.4.3.5	WBS D Test and Labor E Estimal M&S B n/a Notes WBS D Time re Notes WBS D milesto Notes WBS D Assemi	a assembled card una company company care to the from experience of the from experience of the from experience of the from experience of the from exerved for additional care in the prototype Experimental care in the prototype Experimental care in the prototype of the from the prototype of the from the prototype of the prototype	e studies e studies al prototype s Trigger Pi deta meets fu oduction essors Adapters Units 10%	etas. etudies and rototype nctional i/o Process -	algorithm test Testing Correquirements ors Baseline Cost	Act. Cost	Rem 0	11/1/04 10/5/04 10/5/04 0. Cost W	11/1/ 2/28/ 10/25/ Ork Ovt. Wor	04 05	\$0 \$40,340 \$500 ne Work Ac	0 h	\$550 \$550 \$550 Rem. Wo	12 h	\$0	\$0 \$40,890
.2.4.3.5	WBS D Test and Labor E Estimati M&S Bin/a Notes WBS D Time re Notes WBS D Milesto Notes WBS D Assemi	a assembled card una company assembled card una company assemble card una company assemble production assemble produce Disk Resource Name ElecTechU MandS	e studies e studies al prototype s Trigger Pl deta meets fu oduction essors Adapters Units	etas.	algorithm test Testing Co requirements ors	Act. Cost	Rem	11/1/04 10/5/04 10/5/04 0. Cost W	11/1/ 2/28/ 10/25/ ork Ovt. Wol	04 05 04 k Baselir	\$0 \$40,340 \$500 ne Work Ac		\$550 \$550 \$550 Rem. Wo		\$0	\$0 \$40,890

	Name					S	tart	Finish	M&S E	Q M	&S Labor	FNAL Labor	Total Cost
"Produce	Disk Adapters" contin	ued											
	Notes Labor BOE-												
	Technican's time to coor	dinate produ	uction w/ man	ufacturer									
	MACDOE	·											
	M&S BOE- Based of Quotes from or	line survey	(Included in a	attached docur	nentation for F	CB Express) 35	5 boards les	s than 9 square	e inches ~ \$500 t	pased on 20) board estima	te(\$375) + marginal	cost/board of 8.75 for larg
	production (\$375-\$250(s	etup))/20. E	extra PCBs o	ver the 12 need	ded are inexpe	ensive and will c	over the cor	ntingency of ne	eding to install me	ore fast CP	Us.	(, ,	
1.2.4.4.2	Finalize Run	2b SBC o	order			11/2	/04	11/15/04	\$	0	\$0	\$0	\$0
	ID Resource Name	Units	Cost E	Baseline Cost	Act. Cost	Rem. Cost	Work (Ovt. Work E	Baseline Work	Act. Work	Rem. Work	, -	•
	10 PhysicistU	30%	\$0	\$0	\$0	\$0	24 h	0 h	0 h	0 h	24 h		
	Notes												
	WBS Definition- Finialize order details for	cPCI hoard	s for ungrade	of evetem									
		Ci Oi board	o loi apgiaac	or system.									
	M&S BOE- n/a												
	Labor BOE- Experience w/ original Be	ata nrocesso	ore Allow 2	weeks to get t	final quotes no	necible quantity	discounts	and to generate	a P∩s				
	· •		510. 7 (110W Z	. Weeke to get i	mai quotoo, pe								***
.2.4.4.3	Acquire Run					11/16		2/21/05	\$39,84		\$0	\$0	\$39,840
	ID Resource Name 10 PhysicistU	Units 5%	Cost \$0	Baseline Co	st Act. Cos		t Work \$0 24	Ovt. Work	Baseline Worl	k Act. V	Vork Rem.	Work 24 h	
	15 MandS	39,840			\$0 \$0	\$0 \$39,8			"	0		39,840	
	Notes												
	WBS Definition-												
	Procure full complement	of SBC card	ds.										
	M&S BOE-												
				d of Quotes fro	m Advantech a	and VMIC (Inclu	uded in attac	ched document	tation.)				
	M&S BOE-			d of Quotes from	m Advantech a	and VMIC (Inclu	uded in attad	ched document	tation.)				
	M&S BOE- (Prices range 30% acros	s manufactı	urers.) Based			`			tation.)				
	M&S BOE- (Prices range 30% acros	s manufactı	urers.) Based			`			tation.)				
	M&S BOE- (Prices range 30% acros Labor BOE- Experience w/ original Bound Mitigation- Cost:	s manufactu eta processo	urers.) Based ors. Manufad	ctures lead time	es vary from 2-	.12 weeks, depe	ending on sto	ock in hand.	,	ia Du		and the state of t	
	M&S BOE- (Prices range 30% acros Labor BOE- Experience w/ original Be Rick Mitigation- Cost: Contingency is included	s manufactueta processo	urers.) Based ors. Manufac nase of 24 bo	ctures lead time	es vary from 2- f 12. The base	.12 weeks, depe	ending on sto	ock in hand. the most hea	vily loaded proces				
	M&S BOE- (Prices range 30% acros Labor BOE- Experience w/ original Bound Mitigation- Cost:	s manufactueta processo	urers.) Based ors. Manufac nase of 24 bo	ctures lead time	es vary from 2- f 12. The base	.12 weeks, depe	ending on sto	ock in hand. the most hea	vily loaded proces				
2445	M&S BOE- (Prices range 30% across Labor BOE- Experience w/ original Both Rick Mitigation- Cost: Contingency is included greater than expected, 2 BOE.	s manufactueta processor for the purch 4 boards all	ors. Manufactors are of 24 boow for the up-	ctures lead time	es vary from 2- f 12. The base	e plan is to upgr	ending on stored	ock in hand. the most heaver the theaver of 130% is in	vily loaded proces cluded: 100% for	purchase o	of nodes + 30%	6 for price CPU rang	es as noted in the M&S
.2.4.4.5	M&S BOE- (Prices range 30% across Labor BOE- Experience w/ original Both Rick Mitigation- Cost: Contingency is included greater than expected, 2 BOE.	s manufactureta processor for the purch 4 boards allo cion disk a	ors. Manufactures of 24 boow for the up-	ctures lead time pards instead o grade of ALL w	es vary from 2- f 12. The basi vorker nodes in	e plan is to upgranthe system. A	rade the only contingency	ock in hand. of the most hear of 130% is in	vily loaded proces cluded: 100% for \$	purchase o	of nodes + 30% \$0		
.2.4.4.5	M&S BOE- (Prices range 30% across Labor BOE- Experience w/ original Both Rick Mitigation- Cost: Contingency is included greater than expected, 2 BOE.	s manufactueta processor for the purch 4 boards all	ors. Manufactures of 24 boow for the up-	ctures lead time	es vary from 2- f 12. The base	e plan is to upgr	rade the only contingency	ock in hand. of the most hear of 130% is in	vily loaded proces cluded: 100% for \$	purchase o	of nodes + 30%	6 for price CPU rang	es as noted in the M&S
.2.4.4.5	M&S BOE- (Prices range 30% acros) Labor BOE- Experience w/ original Both Rick Mitigation- Cost: Contingency is included greater than expected, 2 BOE. Test product ID Resource Name	s manufactureta processor for the purch 4 boards allo ion disk a Units	ors. Manufactors and provided	ctures lead time pards instead o grade of ALL w	es vary from 2- f 12. The base vorker nodes in	e plan is to upgr the system. A 10/26 Rem. Cost	rade the only contingency	ock in hand. of the most hear of 130% is in 11/1/04 Out. Work	vily loaded proces cluded: 100% for \$ Baseline Work	purchase of the purchase of th	of nodes + 30% \$0 Rem. Work	6 for price CPU rang	es as noted in the M&S
.2.4.4.5	M&S BOE- (Prices range 30% acros Labor BOE- Experience w/ original Bet Rick Mitigation- Cost: Contingency is included greater than expected, 2 BOE. Test product ID Resource Name 10 PhysicistU Notes WBS Definition-	s manufactureta processor for the purcity the top of the purcity that the top of the purcity that the top of the purcity that the top of the to	ors. Manufactors and provided	ctures lead time pards instead o grade of ALL w	es vary from 2- f 12. The base vorker nodes in	e plan is to upgr the system. A 10/26 Rem. Cost	rade the only contingency	ock in hand. of the most hear of 130% is in 11/1/04 Out. Work	vily loaded proces cluded: 100% for \$ Baseline Work	purchase of the purchase of th	of nodes + 30% \$0 Rem. Work	6 for price CPU rang	es as noted in the M&S
.2.4.4.5	M&S BOE- (Prices range 30% acros) Labor BOE- Experience w/ original Both Rick Mitigation- Cost: Contingency is included greater than expected, 2 BOE. Test product ID Resource Name 10 PhysicistU Notes	s manufactureta processor for the purcity the top of the purcity that the top of the purcity that the top of the purcity that the top of the to	ors. Manufactors and provided	ctures lead time pards instead o grade of ALL w	es vary from 2- f 12. The base vorker nodes in	e plan is to upgr the system. A 10/26 Rem. Cost	rade the only contingency	ock in hand. of the most hear of 130% is in 11/1/04 Out. Work	vily loaded proces cluded: 100% for \$ Baseline Work	purchase of the purchase of th	of nodes + 30% \$0 Rem. Work	6 for price CPU rang	es as noted in the M&S
1.2.4.4.5	M&S BOE- (Prices range 30% acros) Labor BOE- Experience w/ original Both Rick Mitigation- Cost: Contingency is included igreater than expected, 2 BOE. Test product ID Resource Name 10 PhysicistU Notes WBS Definition- Test production disk driv Labor BOE-	s manufactureta processor for the purch 4 boards allution disk a Units 25% e adapters.	nase of 24 boow for the up	ctures lead time pards instead o grade of ALL w Baseline Cost \$0	of 12. The base orker nodes in Act. Cost	e plan is to upgr the system. A 10/26 Rem. Cost	rade the only contingency	ock in hand. of the most hear of 130% is in 11/1/04 Out. Work	vily loaded proces cluded: 100% for \$ Baseline Work	purchase of the purchase of th	of nodes + 30% \$0 Rem. Work	6 for price CPU rang	es as noted in the M&S
1.2.4.4.5	M&S BOE- (Prices range 30% acros) Labor BOE- Experience w/ original Both Rick Mitigation- Cost: Contingency is included greater than expected, 2 BOE. Test product ID Resource Name 10 PhysicistU Notes WBS Definition- Test production disk driv Labor BOE- Cycle through all adapted	s manufactureta processor for the purch 4 boards allution disk a Units 25% e adapters.	nase of 24 boow for the up	ctures lead time pards instead o grade of ALL w Baseline Cost \$0	of 12. The base orker nodes in Act. Cost	e plan is to upgr the system. A 10/26 Rem. Cost	rade the only contingency	ock in hand. of the most hear of 130% is in 11/1/04 Out. Work	vily loaded proces cluded: 100% for \$ Baseline Work	purchase of the purchase of th	of nodes + 30% \$0 Rem. Work	6 for price CPU rang	es as noted in the M&S
1.2.4.4.5	M&S BOE- (Prices range 30% acros) Labor BOE- Experience w/ original Both Rick Mitigation- Cost: Contingency is included igreater than expected, 2 BOE. Test product ID Resource Name 10 PhysicistU Notes WBS Definition- Test production disk driv Labor BOE-	s manufactureta processor for the purch 4 boards allution disk a Units 25% e adapters.	nase of 24 boow for the up	ctures lead time pards instead o grade of ALL w Baseline Cost \$0	of 12. The base orker nodes in Act. Cost	e plan is to upgr the system. A 10/26 Rem. Cost	rade the only contingency	ock in hand. of the most hear of 130% is in 11/1/04 Out. Work	vily loaded proces cluded: 100% for \$ Baseline Work	purchase of the purchase of th	of nodes + 30% \$0 Rem. Work	6 for price CPU rang	es as noted in the M&S
	M&S BOE- (Prices range 30% acros Labor BOE- Experience w/ original Both Rick Mitigation- Cost: Contingency is included greater than expected, 2 BOE. Test product ID Resource Name 10 PhysicistU Notes WBS Definition- Test production disk driv Labor BOE- Cycle through all adapted M&S BOE- n/a	s manufactureta processor for the purch 4 boards allution disk a Units 25% e adapters.	nase of 24 boow for the up	ctures lead time pards instead o grade of ALL w Baseline Cost \$0	of 12. The base orker nodes in Act. Cost	e plan is to upgranthe system. A 10/26 Rem. Cost \$0	rade the only contingency	ock in hand. If the most heaving of 130% is in 11/1/04 Out. Work 0 h	vily loaded proces cluded: 100% for \$ Baseline Work 0 h	purchase of O Act. Work O h	\$0 Rem. Work 10 h	6 for price CPU rang \$0	\$0
.2.4.4.5	M&S BOE- (Prices range 30% acros) Labor BOE- Experience w/ original Both Rick Mitigation- Cost: Contingency is included greater than expected, 2 BOE. Test product ID Resource Name 10 PhysicistU Notes WBS Definition- Test production disk driv Labor BOE- Cycle through all adapted M&S BOE-	s manufactureta processor for the purch 4 boards allution disk a Units 25% e adapters.	nase of 24 become for the upper solution of	ctures lead time pards instead o grade of ALL w Baseline Cost \$0	of 12. The base orker nodes in Act. Cost	e plan is to upgr the system. A 10/26 Rem. Cost	rade the only contingency	ock in hand. If the most heavy of 130% is in 11/1/04 Ovt. Work E	vily loaded proces cluded: 100% for \$ Baseline Work 0 h	purchase of the purchase of th	of nodes + 30% \$0 Rem. Work	6 for price CPU rang	es as noted in the M&S

WBS		Name					Sta	art	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost
"Test SBC		inued											
	Notes WBS D	efinition-		-									
		BC boards, retrun a	ny defective l	oards fo	r warranty repair/r	replacement.							
	Labor E	BOE-											
	Experie	ence w/ original Beta	a processors	- plug in	all boards at test	crate. Return	any DOA board	ds.					
	M&S B	OE-											
	n/a												
1.2.4.4.6		L2 Beta Trigg	ger Produ	ction A	nd Testing C	omplete	2/28/	05	2/28/05	\$0	\$0	\$0	\$0
	Notes WPS D	efinition-		=									
		ne: All parts for upg	rade Level 2	Betas in	hand and working	g .							
1.2.5		Silicon Track	Trigger I	Ingrad			12/2/	02	2/28/05	\$172,235	\$58,852	\$3,463	\$234,550
1.2.0	Notes		i iliggei e	pgrau	•		12/2/	02	2/20/00	Ψ172,200	ψ00,002	ψ0,400	Ψ204,000
		efinition-	ludos unarod	on to the	Dun 2a ailiaan tra	ok trigger to s	dont it to the in	orogood n	umbar of innut	from the Dun 2h cilio	on detector. It consi	ata of the producement	of additional alastronic
		of the Run 2a type.								s ironi the Run 20 silic	on detector. It consi	sts of the procurement	or additional electronic
1.2.5.1		Place Parts 0	orders for	I 2 Sili	con Track Tri	gger	4/1/	03	4/1/03	\$0	\$0	\$0	\$0
	Notes		71401010101		oon maak m	990.				•	•	40	•
	WBS D milesto	efinition-		=									
	miesto												
1.2.5.20		Production Re					7/26/		7/30/04	\$0	\$1,292	\$0	\$1,292
	1D 4	Resource Name ElecEngU	Units 50%	Cost \$0	Baseline Cost \$0	Act. Cost \$0	Rem. Cost \$0	Work 20 h	Ovt. Work 0 h	Baseline Work A	Act. Work Rem. Wo	ork 20 h	
	9	PhysicistF PhysicistU	20%	\$0 \$0	\$0 \$0	\$0	\$0 \$0	8 h 40 h	0 h 0 h	0 h	0 h	8 h 40 h	
	10 15	MandS	100% 1,292	\$1,292	\$0 \$0	\$0	\$1,292	1,292	UTI	0 h 0		,292	
	Notes			_									
		efinition- and sign-off for PC	B production	_									
4050					- D Uh DOI	Dunades s	0/0/	0.4	0/0/04	***	***	***	***
1.2.5.2	Notes	Begin L2 Sili	con irack	ırıgge	er Run IID PCI	3 Produc	8/2/	U 4	8/2/04	\$0	\$0	\$0	\$0
	WBS D	efinition-		-									
	milesto	ne: beginRun IIb P	CB production	n.									
1.2.5.3		L2 Silicon Tr	ack Trigge	er Run	IIb Inputs Fin	alized	9/2/	03	9/2/03	\$0	\$0	\$0	\$0
	Notes			=									
		efinition- ne - Format of inpu	ts from upgra	ded L1C	TT and new SMT	are fixed.							
1.2.5.4		VME Mother	noard				4/1/	N3	11/22/04	\$35,991	\$2,880	\$0	\$38,871
1.2.5.4	Notes		Joanu				7/1/	03	11/22/04	Ψ33,331	\$2,000	ΨΟ	Ψ30,07 1
	WBS D	efinition-		-									
	Commo	on 9Ux400 mm VMI	= motherboai	d for all	STI modules. Des	sign is the san	ne as for Run 2	a. 20 boa	rds needed.				
1.2.5.4.1		Place orders					4/1/		4/3/03	\$0	\$480	\$0	\$480
	ID 8	Resource Name ElecTechU	Units 100%	Cost \$0	Baseline Cost \$0	Act. Cost \$0	Rem. Cost \$0	Work 24 h	Ovt. Work	Baseline Work Act	. Work Rem. Work	<u>:</u> ! h	
	o 15	MandS	480	\$480	\$0 \$0	\$0 \$0	\$480	480	UII	0		80	
	Notes			_									
	WBS D	efinition-											

NBS		Name					Star	t	Finish	M&S EQ	M&S La	bor	FNAL Labor	Total Cost
Place or	ders" co	ntinued												
	Notes Cot au	otes, place orders, sl	nin norto, ot	_										
	Get qu	otes, place orders, si	iip parts, et	C.										
		abor BoE- rs @ \$20/hour for ted	shnisian ha	and on Dun	2a avnarianaa f	or oama baard	•							
	24 Hou	is @ \$20/flour for tec	JIIIICIAII DAS	seu on Run	za expenence n	or same board								
1.2.5.4.2		Parts					4/4/03	3	5/30/03	\$13,591		\$0	\$0	\$13,591
	ID 15	Resource Name MandS	Units 13,591	Cost \$13,591	Baseline Cost \$6	Act. Cost 0 \$0	Rem. Cost \$13,591	Work 13,59	Ovt. Work	Baseline Work 0	Act. Work	Rem. Wo	ork 591	
			13,391	\$13,391	φi	<i>y</i>	\$13,391	13,39	,	Ü	Ü	13,	391	
	Notes WBS D	Definition-		_										
	Procur	e parts for motherboa	ards.											
	M&S B	OE-												
	POs fro	om Run 2a purchase	, adjusted fo	or smaller q	uantities (see m	b cost spreads	heet of Run 2a	ourchases	s.)					
.2.5.4.3		Fabricate PCB					8/2/04	ļ	8/27/04	\$7,800		\$0	\$0	\$7,800
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work R	em. Work		
	15	MandS	7,800	\$7,800	\$0	\$0	\$7,800	7,800		0	0	7,800)	
	Notes			_										
		Definition ation of PC boards fo	r motherboa	ards by outs	side vendor.									
	M&S B Quote	oE from Cirexx.												
0.5.4.4		A					0/20/0		0/07/04	£44.000		<u>Ф</u> О		£44.000
.2.5.4.4	10	Assemble	Unite	Coot	Bassline Cost	Ant Cont	8/30/04		9/27/04	\$14,600	A = 4 . 1 A / = = 1 c	\$0 Barra 14/a	\$0	\$14,600
	ID 15	Resource Name MandS	Units 14,600	Cost \$14,600	Baseline Cost \$	Act. Cost 0 \$0	Rem. Cost \$14,600	Work 14,60	Ovt. Work	Baseline Work 0	Act. Work	Rem. Wo	600	
	Notes													
	WBS D	Definition		_										
	Assem	bly of motherboards	by outside \	endor.										
	M&S B			00/l l	1000 NDE - 644	000								
	e-mail	from Whitman: 20 bo	ards @ \$70)U/board + \$	\$600 NRE = \$14	,600								
.2.5.4.5		All L2 Silicon	Track Tr	igger Mo	therboards	Delivere	9/27/04	ļ.	9/27/04	\$0		\$0	\$0	\$0
	Notes	Definition-		_										
		one: All 20 motherboa	ards have be	een receive	d from assembly	/ house.								
.2.5.4.6		Toot					9/28/04	1	11/22/04	\$0	\$2,	400	\$0	\$2,400
.2.3.4.0	ID	Test Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	• Work	1 1/22/04 Ovt. Work			em. Work	ΦΟ	φ 2 ,400
	4	ElecEngU	10%	\$0	\$0	\$0	\$0	32 h	0 h	0 h	0 h	32 h		
	8 15	ElecTechU MandS	20% 2,400	\$0 \$2,400	\$0 \$0	\$0 \$0	\$0 \$2,400	64 h 2,400	0 h	0 h	0 h 0	64 h 2,400		
	Notes		2, 700	ψ <u>2</u> , 700	40	Ψ	Ψ2, 100	2, 100		Ü	Ŭ	2, 100		
	WBS D	Definition-		_										
	Test al	I functions of mother	boards in te	st crate, fix	problems as nee	eded.								
	M&S L	abor BOE-												
	per boa	ard for 20 boards:	Janai											
	per boa 1 hour													

VBS		Name					St	art	Finish	M&S EQ	M&S	S Labor	FNAL Labor	Total Cost
2.5.4.8		L2 Silicon Tra	ack Trigg	jer Moth	erboard Prod	duction (11/22/	04	11/22/04	\$0		\$0	\$0	\$0
	Notes			_										
		efinition- ne: All motherboard:	s have hee	n tested for	hasic functional	ity and are rea	ndv to he install	ed at Ferm	ilah					
	111110010		o nave bee	11 100100 101	badio fariotional	ity and are rec	idy to be include	od dt i oiiii						
.2.5.5		STC Module					4/1/	03	11/22/04	\$21,058		\$1,600	\$0	\$22,658
	Notes			_										
		efinition- ter board that proces	ses raw da	ta from SM	IT Design is the	same as for l	Run 2a: 7 hoard	ls needed						
	Daugin	•			Tr. Boolgino alo	- came ac for i								
.2.5.5.1		Place orders					4/1/	03	4/3/03	\$0		\$480	\$0	\$480
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work		lct. Work	Rem. Work	_	
	8 15	ElecTechU MandS	100% 480	\$0 \$480	\$0 \$0	\$0 \$0	\$0 \$480	24 h 480	0 h	0 h 0	0 h 0	24 h 480		
	Notes			,			,							
		efinition-		_										
	Get quo	otes, place orders, s	hip parts, e	tc.										
	M&S La	abor BoE-												
		rs @ \$20/hour for te	chnician ba	sed on Rui	n 2a experience	with same boa	ards.							
.2.5.5.2		Parts					4/4/	N3	5/30/03	\$15,786		\$0	\$0	\$15,786
.2.5.5.2	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work		Act. Wor		·	ψ13,700
	15	MandS	15,786	\$15,786			60 \$15,78			. Daseille Work			15,786	
	Notes													
		efinition-		_										
	WBS D			_										
	WBS D	Definition- e parts for STCs.		_										
	WBS D Procure M&S B	Definition- e parts for STCs.	adjusted for	- smaller qu	antities (see ST	C cost spread:	sheet from Run	2a purcha	ses) and quote	e from Insight Electr	onics for Xili	nx FPGAs.		
2553	WBS D Procure M&S B	Definition- e parts for STCs. OE Run 2a purchases a		smaller qu	rantities (see ST	C cost spread:							90	\$4 182
.2.5.5.3	WBS D Procure M&S Bo POs of	Definition- e parts for STCs. OE Run 2a purchases a	3	<u> </u>			8/2/	04	8/27/04	\$4,182		\$0	\$0	\$4,182
2.5.5.3	WBS D Procure M&S B POs of	Definition- e parts for STCs. OE Run 2a purchases a	B Units	Cost	Baseline Cost	C cost spread: Act. Cost \$0	8/2/ Rem. Cost	04 Work					<u> </u>	\$4,182
.2.5.5.3	WBS D Procure M&S B POs of	Definition- e parts for STCs. OE Run 2a purchases a Fabricate PCE Resource Name MandS	3	<u> </u>	Baseline Cost	Act. Cost	8/2/	04	8/27/04	\$4,182 Baseline Work	Act. Work	\$0 Rem. Work	<u> </u>	\$4,182
.2.5.5.3	WBS D Procure M&S Be POs of	Definition- e parts for STCs. OE Run 2a purchases a Fabricate PCE Resource Name MandS	B Units	Cost	Baseline Cost	Act. Cost	8/2/ Rem. Cost	04 Work	8/27/04	\$4,182 Baseline Work	Act. Work	\$0 Rem. Work	<u> </u>	\$4,182
.2.5.5.3	WBS D Procure M&S Be POs of ID 15 Notes WBS D	Definition- e parts for STCs. OE Run 2a purchases a Fabricate PCE Resource Name MandS	Units 4,182	Cost \$4,182	Baseline Cost \$0	Act. Cost	8/2/ Rem. Cost	04 Work	8/27/04	\$4,182 Baseline Work	Act. Work	\$0 Rem. Work	<u> </u>	\$4,182
.2.5.5.3	WBS D Procure M&S BG POs of ID 15 Notes WBS D Fabrica	Definition- e parts for STCs. OE Fabricate PCE Resource Name MandS Definition- ation of PC boards for	Units 4,182	Cost \$4,182	Baseline Cost \$0	Act. Cost	8/2/ Rem. Cost	04 Work	8/27/04	\$4,182 Baseline Work	Act. Work	\$0 Rem. Work	<u> </u>	\$4,182
.2.5.5.3	WBS D Procure M&S BI POs of ID 15 Notes WBS D Fabrica M&S BI	Definition- e parts for STCs. OE Fabricate PCE Resource Name MandS Definition- ation of PC boards for	Units 4,182	Cost \$4,182	Baseline Cost \$0	Act. Cost	8/2/ Rem. Cost	04 Work	8/27/04	\$4,182 Baseline Work	Act. Work	\$0 Rem. Work	<u> </u>	\$4,182
	WBS D Procure M&S BI POs of ID 15 Notes WBS D Fabrica M&S BI	Definition- e parts for STCs. OE FRUN 2a purchases a Fabricate PCE Resource Name MandS Definition- ation of PC boards for OE from Cirexx.	Units 4,182	Cost \$4,182	Baseline Cost \$0	Act. Cost	8/2/ Rem. Cost \$4,182	Work 4,182	8/27/04 Ovt. Work	\$4,182 Baseline Work 0	Act. Work 0	\$0 Rem. Work 4,1	82	
	WBS D Procure M&S Bt POs of ID 15 Notes WBS D Fabrica M&S Bt Quote f	Definition- e parts for STCs. OE FRUN 2a purchases a Fabricate PCE Resource Name MandS Definition- ation of PC boards for OE from Cirexx. Assemble	Units 4,182 or STCs by	Cost \$4,182 — outside ver	Baseline Cost \$0 andor.	Act. Cost	8/2/ Rem. Cost \$4,182	04 <u>Work</u> 4,182	8/27/04 Ovt. Work	\$4,182 Baseline Work 0 \$1,090	Act. Work 0	\$0 Rem. Work 4,10	\$0	\$4,182 \$1,090
	WBS D Procures M&S Bi POs of 15 Notes WBS D Fabrica M&S Bi Quote f	Definition- e parts for STCs. OE FRUN 2a purchases a Fabricate PCE Resource Name MandS Definition- ation of PC boards for OE from Cirexx. Assemble Resource Name	Units 4,182 Or STCs by Units	Cost \$4,182 — outside ver	Baseline Cost \$0 andor.	Act. Cost \$0 Act. Cost	8/2/ Rem. Cost \$4,182 8/30/ Rem. Cost	04 Work 4,182 04 Work	8/27/04 Ovt. Work	\$4,182 Baseline Work 0	Act. Work Act. Work	\$0 Rem. Work 4,1: \$0 Rem. Work	\$0	
1.2.5.5.3	WBS D Procure M&S Bt POs of ID 15 Notes WBS D Fabrica M&S Bt Quote f	Definition- e parts for STCs. OE FRUN 2a purchases a Fabricate PCE Resource Name MandS Definition- ation of PC boards for OE from Cirexx. Assemble Resource Name MandS	Units 4,182 or STCs by	Cost \$4,182 — outside ver	Baseline Cost \$0 andor.	Act. Cost	8/2/ Rem. Cost \$4,182	04 <u>Work</u> 4,182	8/27/04 Ovt. Work	\$4,182 Baseline Work 0 \$1,090 Baseline Work	Act. Work 0	\$0 Rem. Work 4,10	\$0	
	WBS D Procure M&S Bi POs of ID 15 Notes WBS D Fabrica M&S Bi Quote f ID 15 Notes	Definition- e parts for STCs. OE FRUN 2a purchases a Fabricate PCE Resource Name MandS Definition- ation of PC boards for OE from Cirexx. Assemble Resource Name MandS	Units 4,182 Or STCs by Units	Cost \$4,182 — outside ver	Baseline Cost \$0 andor.	Act. Cost \$0 Act. Cost	8/2/ Rem. Cost \$4,182 8/30/ Rem. Cost	04 Work 4,182 04 Work	8/27/04 Ovt. Work	\$4,182 Baseline Work 0 \$1,090 Baseline Work	Act. Work Act. Work	\$0 Rem. Work 4,1: \$0 Rem. Work	\$0	
	WBS D Procure M&S BI POS of ID 15 Notes WBS D Fabrica M&S BI Quote f ID 15 Notes WBS D	Definition- e parts for STCs. OE FRUN 2a purchases a Fabricate PCE Resource Name MandS Definition- ation of PC boards for OE from Cirexx. Assemble Resource Name MandS	Units 4,182 or STCs by Units 1,090	Cost \$4,182 — outside ver	Baseline Cost \$0 andor.	Act. Cost \$0 Act. Cost	8/2/ Rem. Cost \$4,182 8/30/ Rem. Cost	04 Work 4,182 04 Work	8/27/04 Ovt. Work	\$4,182 Baseline Work 0 \$1,090 Baseline Work	Act. Work Act. Work	\$0 Rem. Work 4,1: \$0 Rem. Work	\$0	
	WBS D Procure M&S Bt POs of ID 15 Notes WBS D Fabrica M&S Bt Quote f ID 15 Notes WBS D AssemI	Definition- e parts for STCs. OE FRUN 2a purchases a Fabricate PCE Resource Name MandS Definition- ation of PC boards for OE from Cirexx. Assemble Resource Name MandS Definition- bly of STC boards by	Units 4,182 or STCs by Units 1,090	Cost \$4,182 — outside ver	Baseline Cost \$0 andor.	Act. Cost \$0 Act. Cost	8/2/ Rem. Cost \$4,182 8/30/ Rem. Cost	04 Work 4,182 04 Work	8/27/04 Ovt. Work	\$4,182 Baseline Work 0 \$1,090 Baseline Work	Act. Work Act. Work	\$0 Rem. Work 4,1: \$0 Rem. Work	\$0	
	WBS D Procure M&S Bt POs of ID 15 Notes WBS D Fabrica M&S Bt Quote f Notes WBS D Assemt	Definition- e parts for STCs. OE Run 2a purchases a Fabricate PCE Resource Name MandS Definition- ation of PC boards for OE from Cirexx. Assemble Resource Name MandS Definition- bly of STC boards by OE by EMA for 70 STC	Units 4,182 or STCs by Units 1,090 y outside ve	Cost \$4,182 outside ver Cost \$1,090 endor.	Baseline Cost \$0 andor. Baseline Cost \$0	Act. Cost SO Act. Cost \$0	8/2/ Rem. Cost \$4,182 8/30/ Rem. Cost \$1,090	04 Work 4,182 04 Work	8/27/04 Ovt. Work	\$4,182 Baseline Work 0 \$1,090 Baseline Work	Act. Work Act. Work	\$0 Rem. Work 4,1: \$0 Rem. Work	\$0	
	WBS D Procure M&S Bt POs of ID 15 Notes WBS D Fabrica M&S Bt Quote f Notes WBS D Assemt	Definition- e parts for STCs. OE FRUN 2a purchases a Fabricate PCE Resource Name MandS Definition- ation of PC boards for OE from Cirexx. Assemble Resource Name MandS Definition- bly of STC boards by	Units 4,182 or STCs by Units 1,090 y outside ve	Cost \$4,182 outside ver Cost \$1,090 endor.	Baseline Cost \$0 andor. Baseline Cost \$0	Act. Cost SO Act. Cost \$0	8/2/ Rem. Cost \$4,182 8/30/ Rem. Cost \$1,090	04 Work 4,182 04 Work	8/27/04 Ovt. Work	\$4,182 Baseline Work 0 \$1,090 Baseline Work	Act. Work Act. Work	\$0 Rem. Work 4,1: \$0 Rem. Work	\$0	
.2.5.5.4	WBS D Procure M&S Bt POs of ID 15 Notes WBS D Fabrica M&S Bt Quote f Notes WBS D Assemt	Definition- e parts for STCs. OE FRUN 2a purchases a Fabricate PCE Resource Name MandS Definition- ation of PC boards for OE Resource Name MandS Definition- diple of STC boards by OE STC boa	Units 4,182 Units 1,090 y outside ve + NRE (per 100 NRE = \$	Cost \$4,182 — outside ver \$1,090 — endor.	Baseline Cost \$0 andor. Baseline Cost \$0 t doubled to adju	Act. Cost Act. Cost \$0 Act. Cost	8/2/ Rem. Cost \$4,182 8/30/ Rem. Cost \$1,090	04 Work 4,182 04 Work 1,090	8/27/04 Ovt. Work 9/27/04 Ovt. Work	\$4,182 Baseline Work \$1,090 Baseline Work 0	Act. Work Act. Work 0	\$0 Rem. Work 4,10 \$0 Rem. Work 1,00	\$0	\$1,090
	WBS D Procure M&S Bt POs of ID 15 Notes WBS D Fabrica M&S Bt Quote f Notes WBS D Assemil M&S Bt Quote t 7 board	Definition- e parts for STCs. OE FRUN 2a purchases a Fabricate PCE Resource Name MandS Definition- ation of PC boards for OE from Cirexx. Assemble Resource Name MandS Definition- bly of STC boards by OE ds *\$70/board + \$60 All L2 Silicon	Units 4,182 Units 1,090 y outside ve + NRE (per 100 NRE = \$	Cost \$4,182 — outside ver \$1,090 — endor.	Baseline Cost \$0 andor. Baseline Cost \$0 t doubled to adju	Act. Cost Act. Cost \$0 Act. Cost	8/2/ Rem. Cost \$4,182 8/30/ Rem. Cost \$1,090	04 Work 4,182 04 Work 1,090	8/27/04 Ovt. Work	\$4,182 Baseline Work 0 \$1,090 Baseline Work	Act. Work Act. Work 0	\$0 Rem. Work 4,1: \$0 Rem. Work	\$0	
.2.5.5.4	WBS D Procure M&S Bi POs of ID 15 Notes WBS D Fabrica M&S Bi Quote f ID 15 Notes WBS D Assemi M&S Bo Quote t Notes	Definition- e parts for STCs. OE FRUN 2a purchases a Fabricate PCE Resource Name MandS Definition- ation of PC boards for OE from Cirexx. Assemble Resource Name MandS Definition- bly of STC boards by OE ds *\$70/board + \$60 All L2 Silicon	Units 4,182 Units 1,090 y outside ve + NRE (per 100 NRE = \$	Cost \$4,182 — outside ver \$1,090 — endor.	Baseline Cost \$0 andor. Baseline Cost \$0 t doubled to adju	Act. Cost Act. Cost \$0 Act. Cost	8/2/ Rem. Cost \$4,182 8/30/ Rem. Cost \$1,090	04 Work 4,182 04 Work 1,090	8/27/04 Ovt. Work 9/27/04 Ovt. Work	\$4,182 Baseline Work \$1,090 Baseline Work 0	Act. Work Act. Work 0	\$0 Rem. Work 4,10 \$0 Rem. Work 1,00	\$0	\$1,090

VBS		Name					310	art	Finish	M&S EQ	iii oc	S Labor	FNAL	Luboi	Total Cost
.2.5.5.6		Test					9/28/	04	11/22/04	\$0		\$1,120		\$0	\$1,120
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Wo			
	<i>4</i> 8	ElecEngU ElecTechU	4% 8%	\$0 \$0	\$0 \$0		\$0 \$0	12.8 h 25.6 h	0 h 0 h	0 h 0 h	0 h 0 h		2.8 h 5.6 h		
	15	MandS	1,120	\$1,120	\$0		\$1,120	1,120	011	0	0		1,120		
	Notes														
	WBS D	efinition-													
	Test all	I functions of STCs	in test crate,	, fix proble	ms as needed.										
	M&S La	abor BOE-													
		ard for 7 boards:													
		s @ \$40/h for electr s @ \$20/h for techn		r											
		on Run 2a experien		e boards											
		•													
.2.5.5.8		L2 Silicon Tr	ack Trigg	er STC	Production (Complete	11/22/	04	11/22/04	\$0		\$0		\$0	\$0
	Notes	efinition-		_											
		refinition- rne: All STCs have I	been tested	for function	nality and are rea	adv to be install	ed at Fermilab								
						, 10 20 11.01									
.2.5.6		VTM					12/2/	02	8/5/03	\$23,510		\$0	\$'	1,279	\$24,789
	Notes			_											
		efinition-	th four Finie	ar ontical r	eceivers and HD	a-link serial - n	arallel convert	are llead t	o receive data	from silicon detecto	r front ande	Parte are l	hecoming of	heoloto - ne	and 6 more hoards
	spares.		ur iour i iiiise	ai opticai i	cocivers and in	g iiiik scriai - p	aranci convert	C13. O 3Cu t	o receive data	nom sillom detecte	i iioni chas	o. i aits aic i	becoming of	D301CtC - 11C	ca o more boards
	The VN board v	itigation: //E transition modulivas difficult to designate plus 4 spares	in and the re	design red	al receivers and quired if different	HP g-link seria parts have to b	l-to-parallel con e used could n	nverters. So nean signif	ome parts used icant engineeri	d on this board (among costs. To minimi	ong them the	e Finisar red we intend to	ceivers) are o purchase t	about to be he six boar	ecome obsolete. The ds required for the
.2.5.6.1	The VN board v	IE transition module was difficult to design	in and the re	design red	al receivers and quired if different	HP g-link seria parts have to b	l-to-parallel con e used could n	nean signif	ome parts usericant engineeri	d on this board (among costs. To minimi	ong them the	e Finisar ree we intend to	o purchase t	about to be the six boar \$468	ecome obsolete. The ds required for the \$468
.2.5.6.1	The VN board v 2B upg	ME transition modulivas difficult to designate plus 4 spares Place order Resource Name	n and the re as soon as p Units	edesign reconssible. Cost	quired if different Baseline Cost	parts have to b	e used could n 12/2/0 Rem. Cost	nean signif 02 Work	12/3/02 Ovt. Work	ing costs. To minimi \$0 Baseline Work A	ze this risk v	\$0 Rem. Work	o purchase t	he six boar	ds required for the
.2.5.6.1	The VM board v 2B upg	ME transition modulivas difficult to designade plus 4 spares Place order	gn and the re as soon as p	edesign red oossible.	quired if different	parts have to b	e used could n	nean signif	icant engineeri	ng costs. To minimi	ze this risk v	we intend to	o purchase t	he six boar	ds required for the
.2.5.6.1	The VN board v 2B upg	ME transition modulivas difficult to designade plus 4 spares Place order Resource Name ElecTechF	n and the re as soon as p Units	edesign reconssible. Cost	quired if different Baseline Cost	parts have to b	e used could n 12/2/0 Rem. Cost	nean signif 02 Work	12/3/02 Ovt. Work	ing costs. To minimi \$0 Baseline Work A	ze this risk v	\$0 Rem. Work	o purchase t	he six boar	ds required for the
.2.5.6.1	The VM board v 2B upg ID 7 Notes WBS D	ME transition modulivas difficult to designade plus 4 spares Place order Resource Name ElecTechF Definition-	n and the re as soon as p Units	edesign reconssible. Cost	quired if different Baseline Cost	parts have to b	e used could n 12/2/0 Rem. Cost	nean signif 02 Work	12/3/02 Ovt. Work	ing costs. To minimi \$0 Baseline Work A	ze this risk v	\$0 Rem. Work	o purchase t	he six boar	ds required for the
.2.5.6.1	The VM board v 2B upg ID 7 Notes WBS D	ME transition modulivas difficult to designade plus 4 spares Place order Resource Name ElecTechF	n and the re as soon as p Units	edesign reconssible. Cost	quired if different Baseline Cost	parts have to b	e used could n 12/2/0 Rem. Cost	nean signif 02 Work	12/3/02 Ovt. Work	ing costs. To minimi \$0 Baseline Work A	ze this risk v	\$0 Rem. Work	o purchase t	he six boar	ds required for the
.2.5.6.1	ID 7 Notes WBS D Get que Labor E	ME transition modulivas difficult to designade plus 4 spares Place order Resource Name ElecTechF Definition- otes, place order. BOE-	In and the reas soon as p Units 100%	edesign reconssible. Cost	quired if different Baseline Cost	parts have to b	e used could n 12/2/0 Rem. Cost	nean signif 02 Work	12/3/02 Ovt. Work	ing costs. To minimi \$0 Baseline Work A	ze this risk v	\$0 Rem. Work	o purchase t	he six boar	ds required for the
.2.5.6.1	ID 7 Notes WBS D Get que Labor E	ME transition modulivas difficult to designade plus 4 spares Place order Resource Name ElecTechF Definition- otes, place order.	In and the reas soon as p Units 100%	edesign reconssible. Cost	quired if different Baseline Cost	parts have to b	e used could n 12/2/0 Rem. Cost	nean signif 02 Work	12/3/02 Ovt. Work	ing costs. To minimi \$0 Baseline Work A	ze this risk v	\$0 Rem. Work	o purchase t	he six boar	ds required for the
	ID 7 Notes WBS D Get que Labor E	ME transition modulivas difficult to designade plus 4 spares Place order Resource Name ElecTechF Definition- otes, place order. BOE-	In and the reas soon as p Units 100%	edesign reconssible. Cost	quired if different Baseline Cost	parts have to b	e used could n 12/2/0 Rem. Cost	nean signif 02 Work 12 h	12/3/02 Ovt. Work	ing costs. To minimi \$0 Baseline Work A	ze this risk v	\$0 Rem. Work	o purchase t	he six boar	ds required for the
	The VN board v 2B upg ID 7 Notes WBS D Get que Labor E 12 hou	ME transition modulivas difficult to designade plus 4 spares Place order Resource Name ElecTechF Definition- otes, place order. BOE- rs for a Fermilab ter Production Resource Name	Units Chnician Units	cost cost	Baseline Cost \$0	parts have to b Act. Cost \$0 t Act. Cost	e used could n 12/2// Rem. Cost \$468 12/3// Rem. Cost	02 Work 12 h	12/3/02 Ovt. Work 0 h 5/2/03 Ovt. Work	sosts. To minimi \$0 Baseline Work A 0 h \$23,510 Baseline Work	ct. Work O h Act. Wor	\$0 Rem. Work 12 \$0 Rem. Work Rem. Rem.	b purchase t	\$468	ds required for the
	The VN board v 2B upg ID 7 Notes WBS D Get que Labor E 12 hour	ME transition modulivas difficult to designade plus 4 spares Place order Resource Name ElecTechF Definition- otes, place order. 30E- rs for a Fermilab technology.	un and the reas soon as p Units 100%	cdesign rec cossible. Cost \$468	Baseline Cost \$0	Act. Cost	e used could n 12/2// Rem. Cost \$468	02 Work 12 h	12/3/02 Ovt. Work 0 h 5/2/03 Ovt. Work	ng costs. To minimi \$0 Baseline Work A 0 h	ct. Work O h Act. Wor	\$0 Rem. Work 12	o purchase t	\$468	ds required for the
	The VN board v 2B upg ID 7 Notes WBS D Get quo Labor E 12 hour ID 15 Notes	ME transition modulivas difficult to designade plus 4 spares Place order Resource Name ElecTechF Definition- potes, place order. 30E- rs for a Fermilab ter Production Resource Name MandS	Units Chnician Units	cost cost	Baseline Cost \$0	parts have to b Act. Cost \$0 t Act. Cost	e used could n 12/2// Rem. Cost \$468 12/3// Rem. Cost	02 Work 12 h	12/3/02 Ovt. Work 0 h 5/2/03 Ovt. Work	sosts. To minimi \$0 Baseline Work A 0 h \$23,510 Baseline Work	ct. Work O h Act. Wor	\$0 Rem. Work 12 \$0 Rem. Work Rem. Rem.	b purchase t	\$468	ds required for the
	The VN board v 2B upg ID 7 Notes WBS D Get que Labor E 12 houe ID 15 Notes WBS D	ME transition modulivas difficult to designade plus 4 spares Place order Resource Name ElecTechF Definition- otes, place order. BOE- rs for a Fermilab technology Production Resource Name MandS Definition- Definition-	Units Units Chnician Units 23,510	cost \$468 Cost \$23,510	Baseline Cost \$0 Baseline Cost	Act. Cost \$0 t Act. Cost \$0 \$0 \$0	e used could n 12/2// Rem. Cost \$468 12/3// Rem. Cost	02 Work 12 h	12/3/02 Ovt. Work 0 h 5/2/03 Ovt. Work	sosts. To minimi \$0 Baseline Work A 0 h \$23,510 Baseline Work	ct. Work O h Act. Wor	\$0 Rem. Work 12 \$0 Rem. Work Rem. Rem.	b purchase t	\$468	ds required for the
1.2.5.6.1	The VN board v 2B upg ID 7 Notes WBS D Get que Labor E 12 hour ID 15 Notes WBS D	ME transition modulivas difficult to designade plus 4 spares Place order Resource Name ElecTechF Definition- potes, place order. 30E- rs for a Fermilab ter Production Resource Name MandS	Units Units Chnician Units 23,510	cost \$468 Cost \$23,510	Baseline Cost \$0 Baseline Cost	Act. Cost \$0 t Act. Cost \$0 \$0 \$0	e used could n 12/2// Rem. Cost \$468 12/3// Rem. Cost	02 Work 12 h	12/3/02 Ovt. Work 0 h 5/2/03 Ovt. Work	sosts. To minimi \$0 Baseline Work A 0 h \$23,510 Baseline Work	ct. Work O h Act. Wor	\$0 Rem. Work 12 \$0 Rem. Work Rem. Rem.	b purchase t	\$468	ds required for the
	The VN board v 2B upg ID 7 Notes WBS D Get quo Labor E 12 hour ID 15 Notes WBS D Procure M&S B	ME transition modulivas difficult to designade plus 4 spares Place order Resource Name ElecTechF Definition- potes, place order. BOE- rs for a Fermilab ter Production Resource Name MandS Definition- perment of parts, fabro OE-	Units Chnician Units 23,510 ication of PC	Cost \$468 Cost \$23,510 CB and ass	Baseline Cost \$0 Baseline Cost \$0 Baseline Cos	Act. Cost \$0 t Act. Cost \$0 c Act. Cost \$0 c Act. Cost \$0 c Act. Cost \$0 c Cost \$0 c Cost \$0 c Cost	12/2// Rem. Cost \$468 12/3// Rem. Cost \$23,510	02 Work 12 h	12/3/02 Ovt. Work 0 h 5/2/03 Ovt. Work	sosts. To minimi \$0 Baseline Work A 0 h \$23,510 Baseline Work	ct. Work O h Act. Wor	\$0 Rem. Work 12 \$0 Rem. Work Rem. Rem.	b purchase t	\$468	ds required for the
	The VN board v 2B upg ID 7 Notes WBS D Get quo Labor E 12 hour ID 15 Notes WBS D Procure M&S B	ME transition modulivas difficult to designade plus 4 spares Place order Resource Name ElecTechF Definition- otes, place order. BOE- rs for a Fermilab ter Production Resource Name MandS Definition- otes place order.	Units Chnician Units 23,510 ication of PC	Cost \$468 Cost \$23,510 CB and ass	Baseline Cost \$0 Baseline Cost \$0 Baseline Cos	Act. Cost \$0 t Act. Cost \$0 c Act. Cost \$0 c Act. Cost \$0 c Act. Cost \$0 c Cost \$0 c Cost \$0 c Cost	12/2// Rem. Cost \$468 12/3// Rem. Cost \$23,510	02 Work 12 h	12/3/02 Ovt. Work 0 h 5/2/03 Ovt. Work	sosts. To minimi \$0 Baseline Work A 0 h \$23,510 Baseline Work	ct. Work O h Act. Wor	\$0 Rem. Work 12 \$0 Rem. Work Rem. Rem.	b purchase t	\$468	ds required for the
.2.5.6.2	The VN board v 2B upg ID 7 Notes WBS D Get quo Labor E 12 hour ID 15 Notes WBS D Procure M&S B	ME transition modulivas difficult to designade plus 4 spares Place order Resource Name ElecTechF Definition- potes, place order. BOE- rs for a Fermilab ter Production Resource Name MandS Definition- perment of parts, fabro OE-	Units Chnician Units 23,510 ication of PC	Cost \$468 Cost \$23,510 CB and ass	Baseline Cost \$0 Baseline Cost \$0 Baseline Cos	Act. Cost \$0 t Act. Cost \$0 c Act. Cost \$0 c Act. Cost \$0 c Act. Cost \$0 c Cost \$0 c Cost \$0 c Cost	12/2// Rem. Cost \$468 12/3// Rem. Cost \$23,510 contingency).	02 Work 12 h 02 Work 2 y 02 Work 2 3,51	12/3/02 Ovt. Work 0 h 5/2/03 Ovt. Work	\$0 sosts. To minimi \$0 Baseline Work A 0 h \$23,510 Baseline Work	ct. Work O h Act. Wor	\$0 Rem. Work 12 \$0 Rem. Work 0	Work 23,510	\$468	\$468 \$23,510
.2.5.6.2	The VN board v 2B upg ID 7 Notes WBS D Get quo Labor E 12 hour ID 15 Notes WBS D Procure M&S B	ME transition modulivas difficult to designade plus 4 spares Place order Resource Name ElecTechF Definition- otes, place order. BOE- rs for a Fermilab technology MandS Definition- perment of parts, fabro OE- VTM purchased fro	Units Chnician Units 23,510 ication of PC	Cost \$468 Cost \$23,510 Cast sand asservice for F	Baseline Cost \$0 Baseline Cost \$0 Baseline Cos	### Act. Cost ### S0 ### S	12/2// Rem. Cost \$468 12/3// Rem. Cost \$23,510	02 Work 12 h 02 Work 20 03	12/3/02 Ovt. Work 0 h 5/2/03 Ovt. Work	\$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$	ct. Work O h Act. Wor	\$0 Rem. Work 12 \$0 Rem. Work Rem. Rem.	Work 23,510	\$468	ds required for the
.2.5.6.2	ID 7 Notes WBS D Get que Labor E 12 houe ID 15 Notes WBS D Procure M&S B Cost of	ME transition modulivas difficult to designade plus 4 spares Place order Resource Name ElecTechF Definition- otes, place order. BOE- rs for a Fermilab technology MandS Definition- mement of parts, fabrical OCE- VTM purchased from	Units 100% Chnician Units 23,510 ication of PC	Cost \$468 Cost \$23,510 Cast sand asservice for F	Baseline Cost Baseline Cost Baseline Cost Baseline Cost Cost Baseline Cost Baseline Cost Baseline Cost Baseline Cost Baseline Cost	### Act. Cost ### S0 ### S	12/2// Rem. Cost \$468 12/3// Rem. Cost \$23,510 contingency).	02 Work 12 h 02 Work 20 03	12/3/02 Ovt. Work 0 h 5/2/03 Ovt. Work	\$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$	ct. Work O h Act. Won	\$0 Rem. Work 12 \$0 Rem. O	Work 23,510	\$468	\$468 \$23,510
	ID ID ID ID IS Notes WBS D Get que Labor E 12 hour ID Notes WBS D Frocure M&S B Cost of	ME transition modulivas difficult to designade plus 4 spares Place order Resource Name ElecTechF Definition- otes, place order. BOE- rs for a Fermilab technology MandS Definition- mement of parts, fabrication OE- VTM purchased from Test Resource Name ElecTechF	Units Units 23,510 Units Units Units	Cost \$468 Cost \$23,516 CB and asservice for F	Baseline Cost Baseline Cost Baseline Cost Baseline Cost Baseline Cost Baseline Cost	### Act. Cost	12/2// Rem. Cost \$468 12/3// Rem. Cost \$23,510 contingency). 5/2// Rem. Cost	02 Work 12 h 02 Work 02 03 Work	12/3/02 Ovt. Work 0 h 5/2/03 Ovt. Work	scosts. To minimi \$0 Baseline Work A 0 h \$23,510 Baseline Work 6 \$0 Baseline Work	ct. Work Act. Work ct. Work	\$0 Rem. Work 12 \$0 Rem. Work 0	Work 23,510	\$468	\$468 \$23,510

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VBS		Name					St	art	Finish	M&S EQ	M&S La	bor	FNAL Labor	Total Cost
Test" con	Notes Labor BoE	E- rmilab Electronics	s Technicia	<u> </u>										
.2.5.6.5	Notes WBS Defi	vTM Producti nition- : VTMs tested and		_		rack Triç	8/5/	03	8/5/03	\$0		\$0	\$0	\$0
1.2.5.7	Notes WBS Defi	Link Transmit nition- oard with three se		_	for intermodule da	ata transfer. Do	4/1/		11/8/04 Run 2a. We ne	\$9,469 ed 52 boards.	\$1,:	280	\$0	\$10,749
1.2.5.7.1	Notes WBS defir Get quote	s, place orders, s			Baseline Cost \$0 \$0	Act. Cost \$0 \$0 \$0	4/1/ Rem. Cost \$0 \$240	Work 12 h 240	4/2/03 Ovt. Work 0 h	0 h 0		240 m. Work 12 h 240	\$0 -	\$240
1.2.5.7.2	ID II 15 I Notes WBS Defir Procure po	Parts Resource Name MandS nition- arts for LTBs	Units 6,561	Cost \$6,561	Baseline Cost \$0	Act. Cost \$0	4/2/ Rem. Cost \$6,561	03 Work 6,561	5/29/03 Ovt. Work	\$6,561	Act. Work R	\$0 Rem. Work 6,56	\$0	\$6,561
1.2.5.7.3	ID II 15 I Notes WBS Defire Fabricatio M&S BoE Quote from	n of LTB PC boar	Units 2,190 ds by outsin	RE (double	e per board cost t		8/2/ Rem. Cost \$2,190	04 <u>Work</u> 2,190	8/27/04 Ovt. Work	\$2,190 Baseline Work 0	Act. Work R	\$0 Rem. Work 2,190	\$0 •	\$2,190
1.2.5.7.4	ID F 15 I Notes WBS Defi	of LTB boards by	Units 718 r outside ve	Cost \$718 endor	Baseline Cost \$0	Act. Cost \$0	8/30/ Rem. Cost \$718	04 Work 718	9/27/04 Ovt. Work	\$718 Baseline Work Ac	st. Work Rem 0	\$0 n. Work 718	\$ 0 -	\$718

10555		Name					Sta	ırt	Finish	M&S EQ	M&S	Labor	FNAL Labor	Total Cost
.2.5.7.5		All L2 Silicon	Track T	rigger L'	TBs Delivered	t	9/27/0)4	9/27/04	\$0		\$0	\$0	\$0
	Notes			_										
		efinition- ne: All LTBs have b	een receive	d from the	assembly house									
				<u> </u>										
1.2.5.7.6		Test					9/28/0)4	11/8/04	\$0	\$	1,040	\$0	\$1,040
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work		Act. Work	Rem. Wor		
	8 15	ElecTechU MandS	33% 1,040	\$0 \$1,040	\$0 \$0	\$0 \$0	\$0 \$1,040	79.2 h 1,040	0 h	0 h 0	0 h 0		2 h 040	
	Notes													
	WBS D	Definition- I functions of LTBs in	n test PC, fi	x problems	s as needed.									
	Labor E 1 hour	BOE- ② \$20/h for technic	ian per boa	d for 52 bo	oards based on Ri	un 2A experie	nce with same	boards.						
.2.5.7.8		L2 Silicon Tra	ack Trigg	er LTB	Production C	omplete	11/8/0)4	11/8/04	\$0		\$0	\$0	\$0
	Notes			_										
		efinition- one: All LTBs have b	een tested t	for basic fu	nctionality and ar	e ready to be i	nstalled at Ferr	milah						
				57 DUGIO 10		5 . Gady 10 DE 1			4414=10:	***		4.400		***
1.2.5.8		Link Receive	r Board				4/1/0	13	11/15/04	\$12,017	\$	1,160	\$0	\$13,177
	Notes WBS D	Definition-		_										
		board with three se	erial link red	eivers for i	ntermodule data t	transfer. Desig	n is the same a	as for Run	2a. 46 boards	needed.				
.2.5.8.1		Place orders					4/1/0	03	4/2/03	\$0		\$240	\$0	\$240
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work Ac	t. Work	Rem. Work		
	8 15	ElecTechU MandS	100% 240	\$0 \$240	\$0 \$0	\$0 \$0	\$0 \$240	12 h 240	0 h	0 h 0	0 h 0	12 h 240		
			240	φ 2 40	<i>\$</i> 0	90	\$240	240		Ü	U	240	,	
	Notes													
	WBS d	efinition-												
		efinition- otes, place orders, s	ship parts, e	tc										
	Get qu		ship parts, e	tc										
	Get que	otes, place orders, s			t with LTB place c	order task) bas	ed on Run 2a e	experience	with same bo	ards.				
1.2.5.8.2	Get que	otes, place orders, s abor BOE- rs @ \$20/hour for te			t with LTB place c	order task) bas	ed on Run 2a e	-				\$0	\$0	\$9.297
1.2.5.8.2	Get que	otes, place orders, s abor BOE- rs @ \$20/hour for te Parts	echnician (sl	nared effor			4/2/0	03	5/29/03	\$9,297	Act. Work	\$0 Rem. Work	\$0	\$9,297
1.2.5.8.2	Get que	otes, place orders, s abor BOE- rs @ \$20/hour for te			t with LTB place o	order task) bas Act. Cost \$0		-		\$9,297	Act. Work	\$0 Rem. Work	K	\$9,297
1.2.5.8.2	M&S Land 12 hou	otes, place orders, s abor BOE- rs @ \$20/hour for te Parts Resource Name MandS	echnician (sl	nared effor	Baseline Cost	Act. Cost	4/2/(Rem. Cost)3 Work	5/29/03	\$9,297 Baseline Work		Rem. Work	K	\$9,297
1.2.5.8.2	M&S Land 12 hour ID 15 Notes WBS D	otes, place orders, s abor BOE- rs @ \$20/hour for te Parts Resource Name MandS Definition-	echnician (sl	nared effor	Baseline Cost	Act. Cost	4/2/(Rem. Cost)3 Work	5/29/03	\$9,297 Baseline Work		Rem. Work	K	\$9,297
1.2.5.8.2	M&S Land 12 hour ID 15 Notes WBS D	otes, place orders, s abor BOE- rs @ \$20/hour for te Parts Resource Name MandS	echnician (sl	nared effor	Baseline Cost	Act. Cost	4/2/(Rem. Cost)3 Work	5/29/03	\$9,297 Baseline Work		Rem. Work	K	\$9,297
1.2.5.8.2	M&S L 12 hou ID 15 Notes WBS E Procure M&S B	otes, place orders, s abor BOE- rs @ \$20/hour for te Parts Resource Name MandS Definition- e parts for LRBs OE	units 9,297	Cost \$9,297	Baseline Cost \$0	Act. Cost \$0	4/2/(Rem. Cost \$9,297	03 Work 9,297	5/29/03 Ovt. Work	\$9,297 Baseline Work		Rem. Work	K	\$9,297
	M&S L 12 hou ID 15 Notes WBS E Procure M&S B	otes, place orders, s abor BOE- rs @ \$20/hour for te Parts Resource Name MandS Definition- e parts for LRBs OE	Units 9,297	Cost \$9,297	Baseline Cost \$0	Act. Cost \$0	4/2/(Rem. Cost \$9,297	03 <u>Work</u> 9,297 m Run 2a	5/29/03 Ovt. Work	\$9,297 Baseline Work 0		Rem. Work	k 197	. ,
	M&S L 12 hou ID 15 Notes WBS E Procure M&S B	otes, place orders, s abor BOE- rs @ \$20/hour for te Parts Resource Name MandS Definition- e parts for LRBs OE	Units 9,297	Cost \$9,297	Baseline Cost \$0	Act. Cost \$0	4/2/(Rem. Cost \$9,297	03 <u>Work</u> 9,297 m Run 2a	5/29/03 Ovt. Work	\$9,297 Baseline Work		Rem. Work	K	\$9,297 \$2,010
	Get que M&S L. 12 hou ID 15 Notes WBS D Procure M&S B POs fre	otes, place orders, sabor BOE- rs @ \$20/hour for te Parts Resource Name MandS Definition- e parts for LRBs OE om Run 2a purchase Fabricate PCE Resource Name	Units 9,297 es adjusted Units Units	Cost \$9,297	Baseline Cost \$0 quantities (see Li	Act. Cost \$0 RB/LTB cost s	4/2/0 Rem. Cost \$9,297 spreadsheet fro 8/2/0 Rem. Cost	03 Work 9,297 m Run 2a 04 Work	5/29/03 Ovt. Work	\$9,297 Baseline Work \$2,010 Baseline Work	0 Act. Work	9,2 \$0 Rem. Work	\$0	. ,
	M&S L. 12 hou 15 Notes WBS D. Procure M&S B. POS fro 15 15 15 15 15 15 15 1	otes, place orders, sabor BOE- rs @ \$20/hour for te Parts Resource Name MandS Definition- e parts for LRBs OE om Run 2a purchase Fabricate PCE Resource Name MandS	Units 9,297	Cost \$9,297	Baseline Cost \$0 quantities (see Li	Act. Cost \$0 RB/LTB cost s	4/2/0 Rem. Cost \$9,297 preadsheet fro 8/2/0	03 Work 9,297 m Run 2a	5/29/03 Ovt. Work	\$9,297 Baseline Work 0	0	9,2 \$0 Rem. Work	\$0	. ,
	M&S L. 12 hou 1/2 hou 1/2 hou 1/5 Notes WBS D Procure M&S B POs fro 1/5 Notes Notes	otes, place orders, sabor BOE- rs @ \$20/hour for te Parts Resource Name MandS Definition- e parts for LRBs OE om Run 2a purchase Fabricate PCE Resource Name MandS	Units 9,297 es adjusted Units Units	Cost \$9,297	Baseline Cost \$0 quantities (see Li	Act. Cost \$0 RB/LTB cost s	4/2/0 Rem. Cost \$9,297 spreadsheet fro 8/2/0 Rem. Cost	03 Work 9,297 m Run 2a 04 Work	5/29/03 Ovt. Work	\$9,297 Baseline Work \$2,010 Baseline Work	0 Act. Work	9,2 \$0 Rem. Work	\$0	. ,
1.2.5.8.2	ID ID IS Notes WBS D Procure M&S B POs fro ID 15 Notes WBS D	otes, place orders, sabor BOE- rs @ \$20/hour for te Parts Resource Name MandS Definition- e parts for LRBs OE om Run 2a purchase Fabricate PCE Resource Name MandS	Units 9,297 es adjusted Units 2,010	Cost \$9,297 for smaller Cost \$2,010	Baseline Cost \$0 quantities (see Li	Act. Cost \$0 RB/LTB cost s	4/2/0 Rem. Cost \$9,297 spreadsheet fro 8/2/0 Rem. Cost	03 Work 9,297 m Run 2a 04 Work	5/29/03 Ovt. Work	\$9,297 Baseline Work \$2,010 Baseline Work	0 Act. Work	9,2 \$0 Rem. Work	\$0	. ,
	ID 15 Notes WBS D Procure M&S B POs fre ID 15 Motes WBS D Fabrica M&S B	otes, place orders, sabor BOE- rs @ \$20/hour for te Parts Resource Name MandS Definition- e parts for LRBs OE OE Rabor BOE Resource Name MandS Definition- de parts for LRBs OE Fabricate PCE Resource Name MandS Definition- ation of LRB PC boa	Units 9,297 es adjusted 3 Units 2,010 erds by outsi	Cost \$9,297 for smaller \$2,010 de vendor	Raseline Cost \$0 quantities (see Li Baseline Cost \$0	Act. Cost \$0 RB/LTB cost s Act. Cost \$0	4/2/0 Rem. Cost \$9,297 spreadsheet fro 8/2/0 Rem. Cost \$2,010	03 Work 9,297 m Run 2a 04 Work	5/29/03 Ovt. Work	\$9,297 Baseline Work \$2,010 Baseline Work	0 Act. Work	9,2 \$0 Rem. Work	\$0	. ,

VBS		Name						art	Finish	M&S EQ	M&S I		FNAL Labor	Total Cost
2.5.8.4		Assemble					8/30/	04	9/27/04	\$710		\$0	\$0	\$710
	ID	Resource Name	Units		aseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work		t. Work R	em. Work	_	
	15	MandS	710	\$710	\$0	\$0	\$710	710		0	0	710		
	Notes WRS D	Definition-		_										
		bly of LRB boards b	y outside vei	ndor										
	M&S B	-Г												
			oards. They	will give us	the same price	for a smaller	quantity of boar	ds. Amou	int guoted inclu	des NRE costs. 46 b	oards * \$10 +	\$250 (NRE	E) = \$710	
					-							-	•	
1.2.5.8.5		All L2 Silicon	Irack Ir	igger LR	Bs Delivere	a	9/27/	04	9/27/04	\$0		\$0	\$0	\$0
	Notes WBS D	Definition-		_										
		ne: All LRBs have b	een receive	d from the a	assembly house									
.2.5.8.6		Test					9/28/	n4	11/15/04	\$0		\$920	\$0	\$920
1.2.5.6.6	ID	Resource Name	Units	Cost B	aseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	•		em. Work	ΨΟ	Ψ320
	8	ElecTechU	30%	\$0	\$0	\$0	\$0	84 h	0 h	0 h	0 h	84 h	_	
	15	MandS	920	\$920	\$0	\$0	\$920	920		0	0	920		
	Notes			_										
		efinition- I functions of LRBs i	n test PC fix	c problems	as needed									
				. р. облогио	ao 1.00a0a									
		abor BOE- @ \$20/hour for tech	nician ner h	nard for 46	hoarde haeed o	n Dun2a avn	erience with sar	ne hoards	,					
	1 11001													
1.2.5.8.8		L2 Silicon Tra	ack Trigg	er LRB P	roduction C	omplete	11/15/	04	11/15/04	\$0		\$0	\$0	\$0
	Notes	Definition-		_										
		petinition- one: All LRBs have b	een tested f	or basic fun	ctionality and a	re ready to be	e installed at Fe	rmilab.						
									44/00/04	* 40.040				004.000
1.2.5.9		BC Module					4/1/	03	11/22/04	\$18,910	\$2	2,480	\$0	\$21,390
	Notes WBS D	Definition-		_										
	Daught	ter board that buffer	s data for rea	adout to L3	when an L2 acc	ept is issued	. Design is the	same as f	or Run 2a. 20 t	boards needed.				
1.2.5.9.1		Place orders					4/1/	03	4/3/03	\$0		\$480	\$0	\$480
	ID	Resource Name	Units	Cost E	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	•		Rem. Work	Ψ	Ψ100
	8	ElecTechU	100%	\$0	\$0	\$0	\$0	24 h	0 h	0 h	0 h	24 h	_	
	15	MandS	480	\$480	\$0	\$0	\$480	480		0	0	480		
	Notes			_										
		efinition- otes, place orders, s	hip parts, et	С										
		•		-										
		ahor RoF-	chnician had	sed on Run	2a experience v	with same bo	ards							
	M&S La				0politolio0 (501110 00								
		rs @ \$20/hour for te	cillician bas				1/1/	03	5/30/03	\$13,000		\$0	\$0	\$13,000
.2.5.9.2	24 hou	rs @ \$20/hour for te											/ /-	
1.2.5.9.2	24 hou	rs @ \$20/hour for te Parts Resource Name	Units	Cost	Baseline Cost		Rem. Cost	Wor			Act. Work	Rem. W		
1.2.5.9.2	24 hou <u>ID</u> 15	Parts Resource Name MandS		Cost \$13,000				Wor	k Ovt. Worl	k Baseline Work 0			3,000	
1.2.5.9.2	24 hou ID 15 Notes	Parts Resource Name MandS	Units				Rem. Cost	Wor						
1.2.5.9.2	24 hou ID 15 Notes WBS D	Parts Resource Name MandS	Units				Rem. Cost	Wor						
1.2.5.9.2	24 hou ID 15 Notes WBS D Place of	Parts Resource Name MandS Definition- porder for parts.	Units				Rem. Cost	Wor						
1.2.5.9.2	24 hou ID 15 Notes WBS D Place C	Parts Resource Name MandS Definition- porder for parts.	Units 13,000	\$13,000 _	\$	SO .	f Rem. Cost \$0 \$13,00	Wor 0 13,						

ID 15 Notes WBS D	Resource Name MandS	Units				8/2/0	4	8/27/04	\$3,950		\$0	\$0	\$3,950
15 Notes		Units	_			0, 2, 0	•	0/21/01	ψ0,000		4.0	ΨΟ	ψ0,000
Notes	IVIATIUS	3,950	Cost \$3,950	Baseline Cost \$0	Act. Cost \$0	Rem. Cost \$3,950	Work 3,950	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
		3,950	\$3,950	\$0	\$0	\$3,950	3,950		U	U	3,950	,	
	efinition-		-										
	ition of PC boards by	y outside ve	ndor										
M&S B	nF-												
		djusted for s	maller qua	antity \$950 (setup) + 20 boards	* \$150 = \$3950							
	Assemble					8/30/0	<u></u>	9/27/04	\$1,960		\$0	0.2	\$1,960
ID		l Inits	Cost	Baseline Cost	Act Cost					Act Work		ΨΟ	ψ1,500
15	MandS	1,960	\$1,960	\$0	\$0	\$1,960	1,960	OVI. WOIR	0	0)	
Notes													
			_										
Assemi	bly of boards by outs	side vendor											
Cost of	Run 2A purchase a	djusted for s	maller qua	antity \$800 (setup) + 20 boards	* \$58 = \$1960							
	All L2 Silicon	Track Tr	igger Bo	Cs Delivered		9/27/0	4	9/27/04	\$0		\$ 0	\$0	\$0
Notes			_										
			<u> </u>										
milesto	ne: All BCs have be	en received	from the a	ssembly house.									
	Test					9/28/0	4	11/22/04	\$0	5	\$2,000	\$0	\$2,000
ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
4 8		6% 20%		\$0 \$0		\$0 \$0		0 h					
15	MandS	2,000	\$2,000	\$0	\$0	\$2,000	2,000	0 11	0	0			
Notes			_										
		444- 6 :											
rest all	tunctions of BCs in	test crate, fi	x problems	s as needed.									
		rical engine	er										
3 hours	@ \$20/hour for tecl	nnician											
based o	on Run 2a experienc	e with same	boards.										
	L2 Silicon Tra	ick Trigg	er BC Pi	roduction Co	mplete	11/22/0	4	11/22/04	\$0		\$0	\$0	\$0
Notes					•								
		44 6		-tilitd		-t-ll-d-t	1-1-						
milesto	ne: All BCs nave be	en tested fo	r basic tun	ctionality and are	ready to be in	stalled at Ferm	iab.						
	TFC Module					4/1/0	3	12/8/04	\$38,397		\$4,000	\$0	\$42,397
			_										
		aioctory to k	nite in SMT	and CET Docide	a ic the came	as for Dun 2a. 9	hoarde n	oodod					
Daugiii	ei boaid tilat lits a ti	ajectory to i	iilo iii Oivi i	and CF1. Design	i is the same	as ioi Ruii Za. C	boarus II	eeueu.					
	Parts					4/1/0	3	5/27/03	\$25,997		\$0	\$0	\$25,997
ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work				
	MandS	25,997	\$25,997	\$0	\$0	\$25,997	25,99	1/	0		υ 25,	,997	
Notes	ofinition		_										
	ID 15 Notes WBS D Assemi M&S B Cost of Notes WBS D milesto ID 4 8 15 Notes WBS D Test all M&S Laper boat 1 hour 3 hours based of Notes WBS D milesto Notes WBS D milesto	Assemble ID Resource Name 15 MandS Notes WBS Definition- Assembly of boards by outs M&S BoE- Cost of Run 2A purchase a All L2 Silicon Notes WBS Definition- milestone: All BCs have bee Test ID Resource Name 4 ElecEngU 8 ElecTechU 15 MandS Notes WBS Definition- Test all functions of BCs in M&S Labor BOE- per board for 20 boards: 1 hour @ \$40/hour for tech Sulicon Train Notes WBS Definition- milestone: All BCs have bee TFC Module Notes WBS Definition- milestone: All BCs have bee TFC Module Notes WBS Definition- Daughter board that fits a train Parts ID Resource Name 15 MandS	Assemble ID	Assemble ID	Assemble ID Resource Name Units Cost Baseline Cost Notes WBS Definition- Assembly of boards by outside vendor M&S BoE- Cost of Run 2A purchase adjusted for smaller quantity \$800 (setup All L2 Silicon Track Trigger BCs Delivered Notes WBS Definition- milestone: All BCs have been received from the assembly house. Test ID Resource Name Units Cost Baseline Cost 4 ElecEngU 6% \$0 \$0 8 ElecTechU 20% \$0 \$0 15 MandS 2,000 \$2,000 \$0 Notes WBS Definition- Test all functions of BCs in test crate, fix problems as needed. M&S Labor BOE- per board for 20 boards: 1 hour @ \$40/hour for electrical engineer 3 hours @ \$20/hour for technician based on Run 2a experience with same boards. L2 Silicon Track Trigger BC Production Col Notes WBS Definition- milestone: All BCs have been tested for basic functionality and are TFC Module Notes WBS Definition- Daughter board that fits a trajectory to hits in SMT and CFT. Design Parts ID Resource Name Units Cost Baseline Cost 15 MandS 25,997 \$25,997 \$0 Notes WBS Definition- SOMES WBS Definition- Daughter board that fits a trajectory to hits in SMT and CFT. Design	Assemble D Resource Name Units Cost Baseline Cost Act. Cost 15 MandS 1,960 \$1,960 \$0 \$0 Notes WBS Definition-	Assemble B/30/10 Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost 15 MandS 1,960 \$1,960 \$0 \$0 \$0 \$51,960 \$0 \$0 \$0 \$1,960 \$	D	Assemble	Assemble International Process Asternational Pro	Assemble	Assemble	Assemble B/30/104 B/30/104 S1,960 S0 S0 S0 S1,960 S0 S0 S1,960 S0 S0 S1,960 S0 S1,960 S0 S1,960 S0 S0 S1,960 S0 S0 S0 S0 S0 S0 S0

M&S BoE-

VBS		Name					Sta	art	Finish	M&S EQ	M&S	S Labor	FNAL Labor	Total Cost
Parts" cont	tinued													
-	Notes													
,	See spr	readsheet and web	quote from	i exas inst	ruments.									
.2.5.10.2		Fabricate PCE	3				8/2/0)4	8/27/04	\$7,800		\$0	\$0	\$7,800
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
-	15	MandS	7,800	\$7,800	\$0	\$0	\$7,800	7,800		0	0	7,800)	
-	Notes													
		efinition- ition of PC boards b	v outside v	endor										
			y outoide v	oridor.										
	M&S Bo	oE- brication per P.O. to	o Circuit Te	chnology Ir	nc for Run 2A TFC	boards; 8 boa	ards * \$975 = \$	7800						
2.5.10.3		Assemble and	d rework				8/30/0)4	9/27/04	\$4,600		\$0	\$0	\$4,600
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work	·	. ,
-	15	MandS	4,600	\$4,600	\$0	\$0	\$4,600	4,600		0	0	4,600)	
	Notes			_										
		efinition- bly of boards by out	oido vondo	r: uouolly o	omo BCAo roquiro	rowerk boos	ing had golder	iointo ann	oor during orig	inal accombly				
,	ASSEIII	bly of boards by out	Side veridoi	i, usualiy si	onie bgas require	rework becar	ise bad solder	Joints app	ear during ong	iliai assembly.				
	M&S B					FOT								
		rom Micro Contract ls * (\$375 (assembl				ESI;								
	- 200.0		• •											
.2.5.10.4			Track T	rigger T	FCs Delivered		9/27/0)4	9/27/04	\$0		\$0	\$0	\$0
į	Notes	efinition-												
		ne: All TFCs have b	een receive	ed from the	assembly house.									
.2.5.10.5		Test					9/28/0	74	12/8/04	\$0		\$4,000	\$0	\$4,000
.2.5.10.5	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work	ΨΟ	Ψ+,000
-	4	ElecEngU	25%	\$0	\$0	\$0	\$0	100 h	0 h	0 h	0 h	100 /	1	
	15	MandS	4,000	\$4,000	\$0	\$0	\$4,000	4,000		0	0	4,000)	
-	Notes													
		efinition- functions of boards	s in test crat	te fix probl	ems as needed									
			o iii toot orai	io, iix probi	cino do necaca.									
		abor BOE- urs @ \$40/hour for	oloctrical or	aginoor bas	od on ovnorionco	with came he	arde in Dun 2a							
	100 1100	urs @ \$40/11001 101	electrical el	igineer bas	sed on expendice	with same bo	alus III Null Za	•						
.2.5.10.7		L2 Silicon Tra	ack Trigg	ger TFC	Production Co	omplete	12/8/0)4	12/8/04	\$0		\$0	\$0	\$0
;	Notes			_										
		efinition- ne: All TFCs have b	neen tested	for basic fu	inctionality and ar	e ready to be	installed at Fer	milab						
					and and and an									
.2.5.11		Hotlink Repe	aters				4/1/0	03	1/22/04	\$7,500		\$5,600	\$0	\$13,100
;	Notes			_										
		ictionary - boards are rquired t	o merge the	e outputs o	f two TFCs into a s	single hotlink	output. They ar	e boards t	hat fit into the	PC-MIP slots of the	motherboar	d. They have a	PCI target interface	to receive the outp
(one TF	C and a hotlink rece	eiver to rece	eive the out	put of another TF	C, some logic	in an Altera FP	GA to me	rge the two str	eams, and a hotlink	transmitter	for output of th	e merged data to L20	CTT. This is the on
l	board th	hat has to be desigr	ned for the	Run 2b ST	T upgrade.									
.2.5.11.1		Design & prot	otyping				4/1/0	03	5/27/03	\$0		\$5,000	\$0	\$5,000
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work	•	. ,
-	4	ElecEngU	100%	\$0	\$0	\$0	\$0	320 h	0 h	0 h	0 h	320 /		
	15	MandS	5,000	\$5,000	\$0	\$0	\$5,000	5,000		0	0	5,000	7	

VBS		Name					S	tart	Finish	M&S	EQ	M&S Labor	FNAL Labor	Total Cost
esign & p	prototy	ping" continued												
	Notes			_										
		efinition - p precise specificati	ons engine	eering des	ion and layout of	the board: bu	ild a prototype a	and test it						
			o, og	g acc	.g., a.i.a iayoat oi	200.0, 20	a p. o.o., po							
	M&S B		¢1000/was	L L \$4000	for prototype our	naliaa								
	4 week	s of engineering @	\$1000/wee	K + \$1000	for prototype sup	opiles								
1.2.5.11.2		Production					5/28	/03	8/20/03	\$7,	500	\$0	\$0	\$7,500
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. W	ork Rem. Wor	rk	
	15	MandS	7,500	\$7,500	\$0	\$0	\$7,500	7,500			0	0 7,5	500	
	Notes			_										
		efinition -	haarda an	ما محمد ما	la tham									
	Order p	parts, produce of PC	boards an	a assemb	ie tnem.									
	M&S B													
	Cost of	hotlink transmitter b	poard for R	un 2a STT	. This board has	additional par	ts (hotlink recei	iver). The c	cost was increa	sed by approxin	ate cost of	these parts. We	need 12 boards -	+ 3 spares @ \$500/boa
.2.5.11.3		Test					8/21	/03	1/22/04		\$0	\$600	\$0	\$600
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	·	ų.	, , , , , , , , , , , , , , , , , , ,
	8	ElecTechU	4%	\$0	\$0	\$0	\$0	32 h	0 h	0 h) h 32 h	1	
	15	MandS	600	\$600	\$0	\$0	\$600	600		0		0 600)	
	Notes													
	WBS di Test ho M&S La	ictionary - otlink repeaters, fix p abor BoE - rs @ \$20/hour for el	ectronics to	echnician			ar boards in Ru	n 2a.						
.2.5.11.5	WBS di Test ho M&S La 30 hour	ictionary - tlink repeaters, fix p abor BoE - rs @ \$20/hour for el	ectronics to	echnician			ar boards in Ru 1/22		1/22/04		\$0	\$0	\$0	\$0
1.2.5.11.5	WBS di Test ho M&S La 30 hour	ictionary - otlink repeaters, fix p abor BoE - rs @ \$20/hour for el	ectronics to	echnician ger Hotl	ink Repeater	s Comple			1/22/04		\$0	\$0	\$0	\$0
1.2.5.11.5	WBS di Test ho M&S La 30 hour	ictionary - titlink repeaters, fix p abor BoE - rs @ \$20/hour for el L2 Silicon Tra definition - rine: All hotlink repea	ectronics to	echnician ger Hotl	ink Repeater	s Comple	1/22	/04		•				
1.2.5.11.5	WBS di Test ho M&S La 30 hour Notes WBS D milesto	ictionary - titlink repeaters, fix p abor BoE - rs @ \$20/hour for el L2 Silicon Tra definition - ne: All hotlink repea	ectronics to	echnician ger Hotl	ink Repeater	s Comple		/04	1/22/04	\$	\$0	\$0 \$160	\$0	
.2.5.11.5	WBS di Test ho M&S La 30 hour Notes WBS D milesto	ictionary - titlink repeaters, fix p abor BoE - rs @ \$20/hour for el L2 Silicon Tra Definition - rne: All hotlink repea	ectronics to	echnician ger Hotl	ink Repeater	s Comple	1/22	/04		\$				
.2.5.11.5	WBS di Test ho M&S La 30 hour Notes WBS D milesto	ictionary - titlink repeaters, fix p abor BoE - rs @ \$20/hour for el L2 Silicon Tra definition - ne: All hotlink repea	ectronics to	echnician ger Hotl — and ready	ink Repeater	s Comple	1/22	/04		\$				
.2.5.11.5	WBS di Test ho M&S La 30 hour Notes WBS D milesto	ictionary - totlink repeaters, fix p abor BoE - rs @ \$20/hour for el L2 Silicon Tra definition - ne: All hotlink repea LVDS Cables definition- for LVDS serial link	ectronics to	echnician ger Hotl — and ready	ink Repeater	s Comple	9/1	/04	10/13/04		333	\$160	\$0	\$993
.2.5.11.5	WBS di Test ho M&S La 30 hour Notes WBS D milesto	ictionary - titlink repeaters, fix p abor BoE - rs @ \$20/hour for el L2 Silicon Tra definition - ne: All hotlink repea LVDS Cables definition- for LVDS serial link Fabricate	ectronics to ack Trigg sters tested as; need 12	echnician ger Hotl and ready	ink Repeater to be installed a	s Comple t D0.	9/1	/04 /04	9/29/04	\$	333	\$160		\$993
.2.5.11.5	WBS di Test ho M&S La 30 hour Notes WBS D milesto	ictionary - totlink repeaters, fix p abor BoE - rs @ \$20/hour for el L2 Silicon Tra definition - ne: All hotlink repea LVDS Cables definition- for LVDS serial link Fabricate Resource Name	ectronics to ack Trigg ters tested s; need 12	echnician ger Hotl and ready 25.	ink Repeater to be installed a	t D0.	9/1 9/1 Rem. Cost	/04 /04 /04 Work	10/13/04	\$ Baseline Work	333	\$160 \$0 <i>Rem. Work</i>	\$0	\$993
1.2.5.11.5	WBS di Test ho M&S La 30 hour WBS D milesto WBS D Cables	ictionary - titlink repeaters, fix p abor BoE - rs @ \$20/hour for el L2 Silicon Tra definition - ne: All hotlink repea LVDS Cables definition- for LVDS serial link Fabricate Resource Name MandS	ectronics to ack Trigg sters tested as; need 12	echnician ger Hotl and ready	ink Repeater to be installed a	s Comple t D0.	9/1	/04 /04	9/29/04	\$	333	\$160	\$0	\$993
.2.5.11.5 .2.5.12	WBS di Test ho M&S La 30 hour MBS D milesto Notes WBS D Cables	ictionary - titlink repeaters, fix p abor BoE - rs @ \$20/hour for el L2 Silicon Tra definition - rne: All hotlink repea LVDS Cables definition- for LVDS serial link Fabricate Resource Name MandS	ectronics to ack Trigg ters tested s; need 12	echnician ger Hotl and ready 25.	ink Repeater to be installed a	t D0.	9/1 9/1 Rem. Cost	/04 /04 /04 Work	9/29/04	\$ Baseline Work	333	\$160 \$0 <i>Rem. Work</i>	\$0	\$993
.2.5.12 .2.5.12	WBS di Test ho M&S La 30 hour WBS D milesto WBS D Cables ID 15 Notes WBS D	ictionary - titlink repeaters, fix p abor BoE - rs @ \$20/hour for el L2 Silicon Tra definition - ne: All hotlink repea LVDS Cables definition- for LVDS serial link Fabricate Resource Name MandS	ectronics to ack Trigg ters tested s; need 12 Units 833	ger Hotl and ready 25.	ink Repeater to be installed a	t D0.	9/1 9/1 Rem. Cost	/04 /04 /04 Work	9/29/04	\$ Baseline Work	333	\$160 \$0 <i>Rem. Work</i>	\$0	\$993
.2.5.12 .2.5.12	WBS di Test ho M&S La 30 hour WBS D milesto WBS D Cables UD 15 Notes WBS D Fabrica	ictionary - iotlink repeaters, fix p abor BoE - rs @ \$20/hour for el L2 Silicon Tra idefinition - ine: All hotlink repea LVDS Cables idefinition- for LVDS serial link Fabricate Resource Name MandS Definition- ation of cables by ou	ectronics to ack Trigg ters tested s; need 12 Units 833	ger Hotl and ready 25.	ink Repeater to be installed a	t D0.	9/1 9/1 Rem. Cost	/04 /04 /04 Work	9/29/04	\$ Baseline Work	333	\$160 \$0 <i>Rem. Work</i>	\$0	\$993
.2.5.11.5 .2.5.12	WBS di Test ho M&S La 30 hour Notes WBS D milesto Notes WBS D Cables ID 15 Notes WBS D Tabrica	ictionary - titlink repeaters, fix p abor BoE - rs @ \$20/hour for el L2 Silicon Tra definition - ne: All hotlink repea LVDS Cables Definition- for LVDS serial link Fabricate Resource Name MandS Definition- ation of cables by ou oE-	ectronics to ack Trigg ters tested s; need 12 Units 833	echnician ger Hotl and ready 25. Cost \$833 cor.	ink Repeater to be installed a Baseline Cost	t D0. Act. Cost	9/1 9/1 Rem. Cost \$833	/04 /04 /04 Work	9/29/04	\$ Baseline Work	333	\$160 \$0 <i>Rem. Work</i>	\$0	\$993
.2.5.12 .2.5.12	WBS di Test ho M&S La 30 hour Notes WBS D milesto Notes WBS D Cables ID 15 Notes WBS D Tabrica	ictionary - ictionary - itlink repeaters, fix p abor BoE - rs @ \$20/hour for el L2 Silicon Tra definition - ine: All hotlink repea LVDS Cables definition- for LVDS serial link Fabricate Resource Name MandS definition- ition of cables by ou oE- from Inside Track Ca	ectronics to ack Trigg ters tested s; need 12 Units 833	echnician ger Hotl and ready 25. Cost \$833 cor.	ink Repeater to be installed a Baseline Cost	t D0. Act. Cost	9/1 9/1 Rem. Cost \$833	/04 /04 /04 /04 /04 /08 /03	9/29/04 Ovt. Work	\$ Baseline Work	333 333 Act. Work	\$160 \$0 \$\frac{Rem. Work}{0} 833	\$0 \$0	\$993
.2.5.12 .2.5.12	WBS di Test ho M&S La 30 hour Notes WBS D milesto Notes WBS D Cables ID 15 Notes WBS D Tabrica	ictionary - titlink repeaters, fix p abor BoE - rs @ \$20/hour for el L2 Silicon Tra definition - ne: All hotlink repea LVDS Cables Definition- for LVDS serial link Fabricate Resource Name MandS Definition- ation of cables by ou oE-	ectronics to ack Trigg ters tested s; need 12 Units 833	echnician ger Hotl and ready 25. Cost \$833 cor.	ink Repeater to be installed a Baseline Cost	t D0. Act. Cost	9/1 9/1 Rem. Cost \$833	/04 /04 /04 /04 /04 /08 /03	9/29/04	\$ Baseline Work	333	\$160 \$0 <i>Rem. Work</i>	\$0	\$993
.2.5.12 .2.5.12	WBS di Test ho M&S La 30 hour WBS D milesto WBS D Cables WBS D Cables WBS D Fabrica M&S Be Quote f	ictionary - ictionary - itlink repeaters, fix p abor BoE - rs @ \$20/hour for el L2 Silicon Tra idefinition - ine: All hotlink repea LVDS Cables idefinition- for LVDS serial link Fabricate Resource Name MandS idefinition- ation of cables by ou oE- from Inside Track Ca Test Resource Name	ectronics to ack Trigg the state tested s; need 12 Units 833 utside vender abling, scal	echnician ger Hotl and ready and ready 25. Cost \$833 or. led to qual	ink Repeater to be installed a Baseline Cost \$0 So So Baseline Cost	t D0. Act. Cost \$0 Act. Cost	9/1 9/1 Rem. Cost \$833 /30 = \$833 9/30 Rem. Cost	/04 /04 /04 /04 /04 /04 /04 /04	9/29/04 Ovt. Work	\$ Baseline Work	333 Act. Work \$0 Act. Work	\$160 \$0 \$\frac{Rem. Work}{0} \text{ 833}	\$0 \$0 3	\$993
.2.5.12 .2.5.12	WBS di Test ho M&S La 30 hour WBS D milesto WBS D Cables UD 15 Notes WBS D Fabrica M&S B Quote f	ictionary - ictionary - ittlink repeaters, fix p abor BoE - rs @ \$20/hour for el L2 Silicon Tra idefinition - ine: All hotlink repea LVDS Cables Definition- for LVDS serial link Fabricate Resource Name MandS Definition- ation of cables by ou oE- from Inside Track Ca Test Resource Name ElecTechU	ectronics to ack Trigg the state of the stat	echnician ger Hotl and ready and ready 25. Cost \$833 or. ed to quar Cost \$0	ink Repeater to be installed a Baseline Cost So Baseline Cost Baseline Cost So	t D0. Act. Cost Cables * \$200 Act. Cost S0	9/1 9/1 Rem. Cost \$833 /30 = \$833 9/30 Rem. Cost \$0	/04 /04 /04 /04 //04 //04 //04	9/29/04 Ovt. Work	\$Baseline Work Baseline Work 0 h	333 Act. Work \$0 Act. Work	\$160 \$0 x Rem. Work 0 833 \$160 x Rem. Work 0 h 8 h	\$0 \$0 3	\$993
.2.5.11.5 .2.5.12	WBS di Test ho M&S La 30 hour WBS D milesto WBS D Cables WBS D Cables WBS D Fabrica M&S Be Quote f	ictionary - ictionary - itlink repeaters, fix p abor BoE - rs @ \$20/hour for el L2 Silicon Tra idefinition - ine: All hotlink repea LVDS Cables idefinition- for LVDS serial link Fabricate Resource Name MandS Definition- ation of cables by ou oE- from Inside Track Ca Test Resource Name ElecTechU MandS	ectronics to ack Trigg the state tested s; need 12 Units 833 utside vender abling, scal	echnician ger Hotl and ready and ready 25. Cost \$833 or. led to qual	ink Repeater to be installed a Baseline Cost \$0 So So Baseline Cost	t D0. Act. Cost \$0 Act. Cost	9/1 9/1 Rem. Cost \$833 /30 = \$833 9/30 Rem. Cost	/04 /04 /04 /04 /04 /04 /04 /04	9/29/04 Ovt. Work	\$ Baseline Work	333 Act. Work \$0 Act. Work	\$160 \$0 \$\frac{Rem. Work}{0} \text{ 833}	\$0 \$0 3	\$993

M&S Labor BoE-

"Test" conti	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost
1001 001111	inued						
	Notes 8 h @ \$20/hour for Electronics Tech based on tests of s	imilar cables for Run 2a					
			40/40/04				
1.2.5.12.4	L2 Silicon Track Trigger LVDS Cab	le Production C 10/13/04	10/13/04	\$0	\$0	\$0	\$0
	Notes WBS Definition-						
	milestone: All LVDS cables have been received, tested a	and are ready to be installed at Fermilab.					
1.2.5.13	Splitters	4/1/03	11/20/03	\$3,250	\$0	\$936	\$4,186
	Notes						
	WBS Definition- Passive optical splitters to create data path into STT. We	e will need 13 units.					
1.2.5.13.1	Go out for bids	4/1/03	6/24/03	\$0	\$0	\$0	\$0
1.2.3.13.1	Notes	4/ 1/03	0/24/03	φυ	ΦΟ	ΦΟ	ΦΟ
	WBS Definition-						
	Get quotes for splitters.						
	Labor BoE-						
	8h of Fermilab Electronics Tech						
1.2.5.13.2	Procure	6/25/03	10/16/03	• •	\$0	\$0	\$3,250
	ID Resource Name Units Cost Basel 15 MandS 3,250 \$3,250		Vork Ovt. Work 3,250	Baseline Work Ad	t. Work Rem. Work 0 3,2		
		90 90 93,200	3,230	U	0 3,2	50	
	Notes WBS Definition-						
	Place order for splitters						
	M&S BoE-						
		t rather than the guoted \$280.					
	Quote from Run 2a purchase. We actually paid \$250/uni 13 units * \$250 = \$3250.						
	13 units * \$250 = \$3250.	·	11/20/02	* 0	* 0	\$026	\$026
1.2.5.13.3	13 units * \$250 = \$3250. Test	10/17/03	11/20/03		\$0 Work Bom Work	\$936	\$936
	13 units * \$250 = \$3250.	10/17/03 Cost Act. Cost Rem. Cost Won		\$0 Baseline Work Act. V	•	_	\$936
1.2.5.13.3	13 units * \$250 = \$3250. Test ID Resource Name Units Cost Baseline 7 ElecTechF 12% \$936 Notes	10/17/03 Cost Act. Cost Rem. Cost Won	k Ovt. Work	Baseline Work Act. V	Vork Rem. Work	_	\$936
1.2.5.13.3	13 units * \$250 = \$3250.	10/17/03 Cost Act. Cost Rem. Cost Won	k Ovt. Work	Baseline Work Act. V	Vork Rem. Work	_	\$936
1.2.5.13.3	Tay units * \$250 = \$3250. ID Resource Name Units Cost Baseline 7 ElecTechF 12% \$936 Notes WBS Definition- Test splitters	10/17/03 Cost Act. Cost Rem. Cost Won	k Ovt. Work	Baseline Work Act. V	Vork Rem. Work	_	\$936
1.2.5.13.3	Test ID Resource Name Units Cost Baseline 7 ElecTechF 12% \$936 Notes WBS Definition- Test splitters Labor BOE-	10/17/03 Cost Act. Cost Rem. Cost Won	k Ovt. Work	Baseline Work Act. V	Vork Rem. Work	_	\$936
1.2.5.13.3	Test ID Resource Name Units Cost Baseline 7 ElecTechF 12% \$936 Notes WBS Definition- Test splitters Labor BOE- 24 hrs of a Fermilab tech for testing.	10/17/03 2 Cost Act. Cost Rem. Cost Wor. \$0 \$0 \$936 2-	k Ovt. Work 4 h 0 h	Baseline Work Act. V	Vork Rem. Work 0 h 24 h	_	
1.2.5.13.3	Test	10/17/03 2 Cost Act. Cost Rem. Cost Wor. \$0 \$0 \$936 2-	k Ovt. Work	Baseline Work Act. V	Vork Rem. Work	_	\$936 \$0
1.2.5.13.3 1.2.5.13.5	Test D Resource Name Units Cost Baseline Test Resource Name Units Cost Baseline TelecTechF 12% \$936 Notes Notes Labor BOE- 24 hrs of a Fermilab tech for testing. Labor Track Trigger Splitter Provides Notes	10/17/03 2 Cost Act. Cost Rem. Cost Wor. \$0 \$0 \$936 2-	k Ovt. Work 4 h 0 h	Baseline Work Act. V	Vork Rem. Work 0 h 24 h	_	
1.2.5.13.3 1.2.5.13.5	Test	10/17/03 2 Cost Act. Cost Rem. Cost Won \$0 \$0 \$936 20 Docurement Com 11/20/03	k Ovt. Work 4 h 0 h	Baseline Work Act. V	Vork Rem. Work 0 h 24 h	_	
1.2.5.13.3 1.2.5.13.5	Test D Resource Name Units Cost Baseline Test Section Test 10/17/03 2 Cost	M Ovt. Work 4 h 0 h 11/20/03	Baseline Work Act. V	Vork Rem. Work 0 h 24 h	\$0	\$0	
1.2.5.13.3 1.2.5.13.5	Test ID Resource Name Units Cost Baseline 7 ElecTechF 12% \$936 Notes WBS Definition- Test splitters Labor BOE- 24 hrs of a Fermilab tech for testing. L2 Silicon Track Trigger Splitter Property Notes WBS Definition-	10/17/03 2 Cost Act. Cost Rem. Cost Won \$0 \$0 \$936 20 Docurement Com 11/20/03	k Ovt. Work 4 h 0 h	Baseline Work Act. V	Vork Rem. Work 0 h 24 h	_	
1.2.5.13.5 1.2.5.14	Test D Resource Name Units Cost Baseline 7 ElecTechF 12% \$936 WBS Definition- Test splitters Labor BOE- 24 hrs of a Fermilab tech for testing. L2 Silicon Track Trigger Splitter Properties Notes WBS Definition- milestone: All splitters have been received, tested and a Fibers Notes WBS Definition- Words WBS Definition- Words WBS Definition-	10/17/03 2 Cost	M Ovt. Work 4 h 0 h 11/20/03	Baseline Work Act. V	Vork Rem. Work 0 h 24 h	\$0	\$0
1.2.5.13.5 1.2.5.14	Test D Resource Name Units Cost Baseline Test Resource Name Units Cost Baseline TelecTechF 12% \$936 Notes WBS Definition- Test splitters Labor BOE- 24 hrs of a Fermilab tech for testing. L2 Silicon Track Trigger Splitter Provides Notes WBS Definition- milestone: All splitters have been received, tested and a Fibers Notes	10/17/03 2 Cost	11/20/03	\$0 \$1,300	## Nork Rem. Work 24 h 24 h	\$0 \$1,248	\$0 \$2,548
1.2.5.13.5 1.2.5.14	Test D Resource Name Units Cost Baseline Test Security Test Test	10/17/03 2 Cost	M Ovt. Work 4 h 0 h 11/20/03	\$0 \$1,300	Vork Rem. Work 0 h 24 h	\$0	\$0
1.2.5.13.5 1.2.5.14 1.2.5.14.1	Test D Resource Name Units Cost Baseline Test Resource Name Units Cost Baseline TelecTechF 12% \$936 Notes WBS Definition- Test splitters Labor BOE- 24 hrs of a Fermilab tech for testing. L2 Silicon Track Trigger Splitter Properties WBS Definition- milestone: All splitters have been received, tested and a Fibers Notes WBS Definition- Optical fibers from splitters to VRBs and to STT. We will	10/17/03 2 Cost	11/20/03	\$0 \$1,300	## Nork Rem. Work 24 h 24 h	\$0 \$1,248	\$0 \$2,548

WBS		Name					Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost
"Go out for	bids"	continued										
	Notes Labor E			_								
		ermilab Electronics	Tech									
105110		Dragues					6/05/02	10/16/02	£4.200		# 0	£4.200
1.2.5.14.2	10	Procure	11-4-	04	Baratina Cast	4-4-04	6/25/03	10/16/03	\$1,300	\$0	\$ 0	\$1,300
	ID 15	Resource Name MandS	Units 1,300	\$1,300	Baseline Cost \$0	Act. Cost \$0	Rem. Cost Work \$1,300 1,30		Baseline Work 0	Act. Work Rem. Work 0 1.3	800	
	Notes		,	,,,,,,			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			,		
	WBS D	Definition- orders for fibers		_								
	M&S B Quote t	OE- from Run 2a purcha	ase - 52 fibers	s * \$25 = \$	1300							
1.2.5.14.3		Test					10/17/03	11/13/03	\$0	\$0	\$1,248	\$1,248
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost Work	Ovt. Work	• -	ict. Work Rem. Work	, ,	¥ · ,= · ·
	7	ElecTechF	20%	\$1,248	\$0	\$0	\$1,248 32 1		0 h	0 h 32	h	
	Notes			_								
	WBS D	efinition- pers										
	Labor E	30E-										
	32 hrs	of a Fermilab Tech										
1.2.5.14.5		L2 Silicon Tr	ack Trigge	er Fiber	Procuremen	nt Compl	11/13/03	11/13/03	\$0	\$0	\$0	\$0
	Notes			_								
	WBS D	efinition-										
			n received te	sted and a	are ready to be in	nstalled at Fer	milah					
		cal fibers have bee			-			42/9/04	***	* 0	¢0	¢0
1.2.5.15	All option	cal fibers have bee			-		12/8/04	12/8/04	\$0	\$0	\$0	\$0
	All option	cal fibers have bee L2 Silicon Tr Definition-	ack Trigge	er Hard	ware Produc			12/8/04	\$0	\$0	\$0	\$0
	All option	cal fibers have bee	ack Trigge	er Hard	ware Produc			12/8/04	\$0	\$0	\$0	\$0
	All option	cal fibers have bee L2 Silicon Tr Definition-	rack Trigge	er Hard	ware Produc			12/8/04	\$0	\$0 \$38,400	\$0	\$0 \$38,400
1.2.5.15	Notes Notes Notes Notes	L2 Silicon Tr Definition- one- All hardware co	rack Trigge	er Hard	ware Produc		12/8/04				•	
1.2.5.15	Notes Notes Notes Notes	L2 Silicon Tr Definition- one- All hardware co	rack Trigge	er Hard	ware Produc		12/8/04				•	
1.2.5.16	Notes WBS D milesto Notes WBS D Risk M	L2 Silicon Tr Definition- one- All hardware co STC firmwar Definition- itigation:	mack Trigge components are	er Hardy - e ready to	ware Production be installed.	tion Con	9/2/03	3/1/04	\$0	\$38,400	\$0	\$38,400
1.2.5.16	Notes WBS D milesto Notes WBS D Risk M The soc	L2 Silicon Tr Definition- one- All hardware co STC firmwar Definition- itigation: ope of this item is r	components are	er Hardy e ready to	ware Product be installed.	tion Con	9/2/03 e inputs to the STT are	3/1/04 all being redesign	\$0 ned for the upgrade.	\$38,400 The engineering budge	\$0	
1.2.5.15	Notes WBS D milesto Notes WBS D Risk M The soc	L2 Silicon Tr Definition- Oefinition- Definition- Defi	omponents are	er Hardy e ready to	ware Product be installed.	tion Con	9/2/03 e inputs to the STT are	3/1/04 all being redesigned, I have assigned	\$0 ned for the upgrade. if 100% contingency f	\$38,400 The engineering budge or this task.	\$0 ted in this item will al	\$38,400 so serve as contingency in
1.2.5.15	Notes WBS D milesto Notes WBS D Risk M The soc	L2 Silicon Tr Definition- nee- All hardware or STC firmwar Definition- itigation: ope of this item is r ny layouts have to li Update STC	components are not yet that we be revised to a firmware	er Hardy e ready to ell defined, accomoda	be installed. since the system te changes due	ms that provide to obsolete pa	9/2/03 e inputs to the STT are rts. To mitigate this ris 9/2/03	3/1/04 all being redesigned, I have assigned 3/1/04	\$0 ned for the upgrade. 1 100% contingency f	\$38,400 The engineering budge for this task. \$38,400	\$0 ted in this item will al	\$38,400
1.2.5.15	Notes WBS D milesto Notes WBS D Risk M The soc case an	L2 Silicon Troperintion- Definition- Defin	components are e not yet that we be revised to a firmware Units 100%	er Hardy e ready to ell defined, accomoda	be installed. since the system te changes due Baseline Cost	ms that provide to obsolete parts Act. Cost	9/2/03 e inputs to the STT are rts. To mitigate this ris 9/2/03 Rem. Cost W 0 \$0	3/1/04 all being redesigner, I have assigner 3/1/04 ork Ovt. Work	so med for the upgrade. If 100% contingency to \$0 Baseline Work	\$38,400 The engineering budge for this task. \$38,400 Act. Work Rem. 1 0 h	\$0 ted in this item will al \$0 Work 960 h	\$38,400 so serve as contingency in
1.2.5.15	Notes WBS D milesto Notes WBS D Risk M The sca	L2 Silicon Tr Definition- One- All hardware co STC firmwar Definition- itigation: ope of this item is r ny layouts have to b Update STC Resource Name ElecEngU MandS	omponents are e not yet that we be revised to a firmware Units	er Hardy e ready to ell defined, accomoda	be installed. since the system te changes due Baseline Cost	ms that provide to obsolete parts Act. Cost	9/2/03 e inputs to the STT are rts. To mitigate this ris 9/2/03 Rem. Cost W 0 \$0	3/1/04 all being redesigned, I have assigned 3/1/04 ork Ovt. Work	\$0 ned for the upgrade. d 100% contingency f \$0 Baseline Work	\$38,400 The engineering budge for this task. \$38,400 Act. Work Rem. 1 0 h	\$0 ted in this item will al	\$38,400 so serve as contingency in
1.2.5.16	Notes WBS D milesto Notes WBS D Risk M The soc case an	L2 Silicon Tropefinition- Definition- Defi	components are e not yet that we be revised to a firmware Units 100%	er Hardy e ready to ell defined, accomoda	be installed. since the system te changes due Baseline Cost	ms that provide to obsolete parts Act. Cost	9/2/03 e inputs to the STT are rts. To mitigate this ris 9/2/03 Rem. Cost W 0 \$0	3/1/04 all being redesigner, I have assigner 3/1/04 ork Ovt. Work	so med for the upgrade. If 100% contingency to \$0 Baseline Work	\$38,400 The engineering budge for this task. \$38,400 Act. Work Rem. 1 0 h	\$0 ted in this item will al \$0 Work 960 h	\$38,400 so serve as contingency in
1.2.5.15	Notes WBS D milesto Notes WBS D Risk M The soc case al ID 4 15 Notes WBS D	L2 Silicon Tr Definition- One- All hardware co STC firmwar Definition- itigation: ope of this item is r ny layouts have to b Update STC Resource Name ElecEngU MandS	montyet that we be revised to a firmware Units 100% 38,400	er Hardy e ready to ell defined, accomoda Cost \$38,400	be installed. since the system te changes due Baseline Cost	ms that provide to obsolete parts Act. Cost	9/2/03 e inputs to the STT are rts. To mitigate this ris 9/2/03 Rem. Cost W 0 \$0	3/1/04 all being redesigner, I have assigner 3/1/04 ork Ovt. Work	so the upgrade. If 100% contingency to \$0 to Baseline Work to \$0 t	\$38,400 The engineering budge for this task. \$38,400 Act. Work Rem. 1 0 h	\$0 ted in this item will al \$0 Work 960 h	\$38,400 so serve as contingency in
1.2.5.15	Notes WBS D milesto Notes WBS D Risk M The soc case an ID 4 15 Notes WBS D Rewrite M&S La	cal fibers have bee L2 Silicon Tr Definition- one- All hardware or STC firmwar Definition- itigation: ope of this item is r ony layouts have to li Update STC Resource Name ElecEngU MandS Definition-	components are e not yet that we be revised to a firmware Units 100% 38,400	er Hardy e ready to ell defined, accomoda Cost \$38,400	be installed. since the systement to changes due Baseline Cost	ms that provide to obsolete part Act. Cost So	9/2/03 e inputs to the STT are rts. To mitigate this ris 9/2/03 Rem. Cost W 0 \$0 0 \$38,400 3	3/1/04 all being redesigner, I have assigner 3/1/04 ork Ovt. Work	so the upgrade. If 100% contingency to \$0 to Baseline Work to \$0 t	\$38,400 The engineering budge for this task. \$38,400 Act. Work Rem. 1 0 h	\$0 ted in this item will al \$0 Work 960 h	\$38,400 so serve as contingency in
1.2.5.15	Notes WBS D milesto Notes WBS D Risk M The soc case an ID 4 15 Notes WBS D Rewrite M&S La	L2 Silicon Tr Definition- one- All hardware co STC firmwar Definition- itigation: ope of this item is r ny layouts have to l Update STC f Resource Name ElecEngU MandS Definition- e firmware for STC abor BOE-	components are e not yet that we be revised to a firmware Units 100% 38,400	er Hardy e ready to ell defined, accomoda Cost \$38,400	be installed. since the systement to changes due Baseline Cost	ms that provide to obsolete part Act. Cost So	9/2/03 e inputs to the STT are rts. To mitigate this ris 9/2/03 Rem. Cost W 0 \$0 0 \$38,400 3	3/1/04 all being redesigner, I have assigner 3/1/04 ork Ovt. Work	so the upgrade. If 100% contingency to \$0 to Baseline Work to \$0 t	\$38,400 The engineering budge for this task. \$38,400 Act. Work Rem. 1 0 h	\$0 ted in this item will al \$0 Work 960 h	\$38,400 so serve as contingency in
1.2.5.16 1.2.5.16	Notes WBS D milesto Notes WBS D Risk M The soc case an ID 4 15 Notes WBS D Rewrite M&S La	cal fibers have bee L2 Silicon Tr Definition- Inne- All hardware or STC firmwar Definition- Itigation: Ope of this item is r Inny layouts have to l Update STC Resource Name ElecEngU MandS Definition- In firmware for STC abor BOE- On engineering effor TFC Code	components are e not yet that we be revised to a firmware Units 100% 38,400	er Hardy e ready to ell defined, accomoda Cost \$38,400	be installed. since the systement to changes due Baseline Cost	ms that provide to obsolete part Act. Cost So	9/2/03 e inputs to the STT are rts. To mitigate this ris 9/2/03 Rem. Cost W 0 \$0 0 \$38,400 3	3/1/04 all being redesigner, I have assigned 3/1/04 Ovt. Work 960 h 8,400	\$0 ned for the upgrade. If 100% contingency to \$0 Baseline Work In 0 h 0	\$38,400 The engineering budge for this task. \$38,400 Act. Work Rem. V 0 h 0	\$0 ted in this item will al \$0 Work 960 h 38,400	\$38,400 so serve as contingency if \$38,400

NBS		Name						tart	Finish	M&S	EQ	M&S	Labor	FNAL Labor	Total Cost
.2.5.17.1		Change TFC	code				9/2	2/03	3/1/04		\$0		\$0	\$0	\$0
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. W		Rem. Work	_	
	10	PhysicistU	100%	\$0	\$0	\$0	\$0	960 h	0 h	0 h		0 h	960 h		
	WRS D	efinition-		_											
		software that runs	in DSPs to	do fits to	increased number	r of silicon la	ers.								
	Labor E	:OF-													
		on effort required to	design Rur	2a TFC	code										
.2.5.18		Downloading	& Monit	orina			9/	2/03	2/2/04		\$0		\$0	\$0	\$0
.2.3.10	Notes	Downloading	o Monit	orning			3/2	2703	2/2/04		Ψυ		φυ	ΨΟ	φ0
		efinition-		_											
.2.5.18.1		Update downl	ooding 9	monito	ring coffware		0//	2/03	2/2/04		\$0		\$0	\$0	\$0
1.2.3.16.1	10	•	-		•	Act Coot						ork	* -	ΦΟ	ΦΟ
	1D 10	Resource Name PhysicistU	Units 100%	Cost \$0	Baseline Cost \$0	Act. Cost \$0	Rem. Cost \$0	Work 800 h	Ovt. Work 0 h	Baseline Work 0 h	Act. W	0 h	Rem. Work 800 h	=	
	Notes	·													
	WBS D	efinition-		_											
	Update	downloading and n	nonitoring s	oftware.											
	Labor E	OE-													
	Based of	on effort required to	design Rur	2a dow	nloading & monito	oring code.									
1.2.5.19		L2 Silicon Tr	ack Trigo	er Pro	duction and	Testina C	12/8	3/04	12/8/04		\$0		\$0	\$0	\$0
	Notes			,							**		**	**	**
		efinition-		_											
	milesto	ne: STT is installed	in MCH2 ar	nd all fun	ctions have been	tested.									
1.2.5.21		L2 Trigger Up	pgrade P	roduct	ion and Testi	ng Compl	2/28	3/05	2/28/05		\$0		\$0	\$0	\$0
	Notes			_											
		efinition- ne: All upgrade Lev	rel 2 system	s in hand	d and working										
					. uu										
1.2.6		Trigger Simu	lation				11/1	I/ 01	3/5/04		\$0		\$0	\$0	\$0
	Notes WRS D	efinition -		_											
			ed the simula	ation tasl	ks that are needed	d to design ar	d optimize the	trigger while	e it is being dev	eloped, and afte	rwards to	provid	e standard to	ols for simulating the	behavior of the as
	system.														
1.2.6.1		L1 Cal Simul	ation Sof	tware			11/	I/ 0 1	11/5/03		\$0		\$0	\$0	\$0
	Notes										**		**	**	**
		efinition -		-		·c u		.							
	I nis su	mmary task describ	es the deve	lopment	of simulation tool	s specifically	for the Level 1	Jaiorimeter	trigger.						
1.2.6.1.1		Develop proto	type L1C	al trigg	er algorithm		11/	I/01	1/24/03		\$0		\$0	\$0	\$0
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. V		Rem. Work	<u></u>	
	10 13	PhysicistU StudentU	50% 50%	\$0 \$0	\$0 \$0	\$0 \$0	\$0 \$0	768 h 1,200 h	0 h 0 h	0 h 0 h		744 h .080 h	24 h 120 h		
		Siddonio	3078	ΨΟ	<i>\$</i> 0	40	40	1,20011	311	011	,	,000 11	12011		
	Notes WBS D	efinition-		_											
		nte Carlo simulatio	n to design	and test	algorithms for jet,	EM and tau of	clustering and g	lobal summ	ning. Develop p	erformance crite	ria for the	ese algo	orithms		
		05													
	Labor E														

WBS		Name						Start	Finish	M&S	S EQ IV	I&S Labor	FNAL Labor	Total Cost
.2.6.1.2		Optimize algo	rithm pe	rforman	ce with simula	ations	1/3	27/03	11/5/03	3	\$0	\$0	\$0	\$0
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	10	PhysicistU	20%	\$0	\$0	\$0	\$0	320 h	0 h	0 h	0 h	320 h		
	Notes													
		efinition - the stand-alone tric	nger simul:	ation used	for design studi	es of the run2h	l 1 calorimet	er trigger in	to the general n	urnose DZero tri	igger simulatio	n nackage ("trig	ı sim")	
		•	, go. oa		.o. doo.g. o.da.	00 01 11.0 14.121		oggo	to the general p	a. poso 220.0 t	990. 0	package (a.g		
	Labor I	BOE - s of physicist time.												
	0 110011													
1.2.6.1.3		Integrate algo	rithm int	o Dzero	Trigger Simu	ılation	1/:	27/03	7/22/03	3	\$0	\$0	\$0	\$0
	1D 10	Resource Name PhysicistU	Units 20%	Cost	Baseline Cost \$0	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
		,	20%	\$0	\$0	\$0	\$0	200 h	0 h	0 h	0 h	200 h		
	Notes WRS F	efinition-		_										
	WDOL	veninition-												
.2.6.2		L1 Cal/Track	Match S	Simulati	on Software		1/3	22/03	3/5/04	ļ	\$0	\$0	\$0	\$0
	Notes													
		efinition - ımmary task describ	es the dev	elopment	of simulation too	ols specifically	for the Level	1 Calorimet	er trigger					
1.2.6.2.1		Develop proto				_		22/03	10/31/03		\$0	\$0	\$0	\$0
	1D 10	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work 800 h		
	13	PhysicistU StudentU	50% 50%	\$0 \$0	\$0 \$0		\$0 \$0		0 h 0 h	0 h 0 h				
	Notes													
	WBS D	efinition-												
	Use Mo	onte Carlo simulatio	n to desigi	n and test	algorithms for je	t, EM and tau	clustering and	l global sum	ıming. Develop	performance crit	eria for these	algorithms		
	Labor I													
	Estima	ted from simulation	effort expe	ended so f	ar.									
1.2.6.2.2		Optimize algo	rithm pe	rforman	ce with simula	ations	11	/3/03	1/23/04	ļ	\$0	\$0	\$0	\$0
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	10	PhysicistU	20%	\$0	\$0	\$0	\$0	80 h	0 h	0 h			_	
	Notes													
		efinition -		tion wood	for docion studi	a a of the wwo Oh	l 1 aalarimaat		to the general m	umasa DZara tri		n naskana ("tria	· aima!!\	
	EIIDeo	the stand-alone trig	gger sirriur	allon useu	ioi design studi	es of the fullzt	LI Calorinet	ei iliggei ili	to the general p	urpose Dzero in	gger simulatio	in package (ing	<u>j_</u> Siiii).	
	Labor I													
	2 week	s of physicist time												
1.2.6.2.3		Integrate algo	rithm int	o Dzero	Trigger Simu	ılation	1/2	26/04	3/5/04	ļ	\$0	\$0	\$0	\$0
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	10	PhysicistU	20%	\$0	\$0	\$0	\$0	48 h	0 h	0 h	0 h	48 h		
	Notes													
	WBS E	efinition-												
1.2.6.3		L1CTT Simul	ation				2	2/1/02	10/31/03	3	\$0	\$0	\$0	\$0
	Notes													
		efinition-		_										
	Use Mo	onte Carlo simulatio	ns and rur	2a data t	o develop optima	al equations fo	r track finding	and mome	ntum binning.					
	Labor I	BOE-												
	Based	on Run2a L1CTTsir	mulation e	kperience.	Most of the sim	ulations are pe	rfomed by ph	ysicists.						

NBS		Name						Start	Finish			S Labor	FNAL Labor	Total Cost
2.6.3.1		Develop proto	otype CT	Γ algorith	m		2/	1/02	1/21/03	9	0	\$0	\$0	\$0
	ID	Resource Name	Units		Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work	_	
	10	PhysicistU	50%	\$0	\$0	\$0	\$0	627.6 h	0 h	0 h	481.2 h	146.4 h		
	WRS D	efinition-		_										
		onte Carlo simulatio	ns and run	2a data to	develop optima	l equations for	r track finding a	and moment	um binning.					
	Labor B	ROF.												
		on Run2a L1CTTsi	mulation ex	perience. M	lost of the simu	ulations are pe	rfomed by phy	sicists.						
.2.6.3.2		Develop proto	otype CT	Γ algorith	m		2/	1/02	1/21/03	•	0	\$0	\$0	\$0
.2.0.3.2	ID	Resource Name	Units	•	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work	ΨΟ	ΨΟ
	9	PhysicistF	100%	\$0	\$0	\$0	\$0	1,920 h	0 h	0 h	1,344 h	576 h	_	
	Notes													
		efinition-												
	Use Mo	onte Carlo simulatio	ons and run	2a data to (develop optima	il equations for	r track finding a	and moment	um binning.					
	Labor B													
	Based	on Run2a L1CTTsi	mulation ex	perience. N	lost of the simu	lations are pe	rfomed by phy	sicists.						
.2.6.3.3		Develop proto	otype CT	Γ algorithi	m		2/	1/02	1/21/03		0	\$0	\$0	\$0
	ID	Resource Name	Units		Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work	- -	
	10	PhysicistU	50%	\$0	\$0	\$0	\$0	960 h	0 h	0 h	672 h	288 h		
	Notes			_										
	WBS D	efinition-	ons and run	— 2a data to d	develop optima	ıl equations fo	r track finding a	and moment	rum binning					
	WBS Do	efinition- onte Carlo simulatio	ons and run	 2a data to	develop optima	ıl equations fo	r track finding a	and moment	tum binning.					
	WBS DO Use Mo Labor B	efinition- onte Carlo simulatio 3OE-				·	J		rum binning.					
	WBS DO Use Mo Labor B	efinition- onte Carlo simulatio 30E- on Run2a L1CTTsi	mulation ex	perience. M	lost of the simu	·	rfomed by phy	sicists.						
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10 Resource Rame Units Cost Seasoline Cost Act Cost Rem. Cost Work Orl. Work Beseline Work Act Work Rem. Work No.	WBS		Name						Start	Finish	M&S	EQ M	&S Labor	FNAL Labor	Total Cost
Note Wis Definition September Sept	.2.6.3.7		Integrate algo	rithm int	o Dzero	Trigger Simula	ation	1/2	22/03	7/17/03		\$0	\$0	\$0	\$0
## STT Simulator STT Simulat			Resource Name	Units	Cost	Baseline Cost	Act. Cost			Ovt. Work	Baseline Work	Act. Work	Rem. Work		
2.6.4 STT Simulator Most		10	PhysicistU	50%	\$0	\$0	\$0	\$0	500 h	0 h	0 h	0 h	500 h		
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Notes		WBS D	efinition-												
WBS definition - This summary task describes the work needed to modify the run2a STT simulation to work with the run2b silicon detector and run2b STT hardware. 2.6.4.1 Update simulator 10 Resource Name Unit Cost Baseline Cost Act Cost Rem. Cost Work Ov. Work Baseline Work Act Work Rem. Work	2.6.4		STT Simulate	or				9/	/2/03	2/2/04		\$0	\$0	\$0	\$0
2.6.4.1 Update simulator Units vork needed to modify the run2a STT simulation to work with the run2b silicon detector and run2b STT hardware. 2.6.4.1 Update simulator 100% S0															
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ID Resource Name Urits Cost Baseline Cost Act Cost Rem Cost Work Ort, Work Baseline Work Act Work Rem Work		This sur	mmary task descri	bes the wo	rk needed	to modify the run.	Za STT Simula	ation to work v	vitri trie runzi	o silicon deteci	tor and runzb 5 r	i naroware.			
To Physicist 100% 50 80 80 80 80 80 80 80	2.6.4.1		Update simula	ator				9/	/2/03	2/2/04		\$0	\$0	\$0	\$0
WBS Definition- Update simulator to reflect changes in hardware. Labor BOE- Done by physicists 2.7 Administration 10/1/02 3/8/05 \$5,500 \$0 \$0 \$5,500 Notes WBS Definition- The summary lask associated with administration of the trigger upgrade project including management, travel, shipping, purchasing support, technical support, and software licenses including both the R project phases. M&S BOE- The cost BOEs are listed per item. The contingency is 50% for all project related items and 30% on the R&D phase which is nearing completion. Labor BOE- The contingency for all tasks is 50%. Physicist contingency is assigned 50% 2.7.1 Project Management 10/1/02 3/8/05 \$0 \$0 \$0 \$0 \$ Resource Mane Units Cost Baseline Cost Act Cost Rem Cost Work Ort. Work Baseline Work Act Work Rem Work 10 Physicist Carried Units Trigger L2 and L3 project managers and their helpers. This task accounts for maintenance of the schedule, organizing meetings and reviews, maintaining and distributing documentation. M&S BOE- There are two L2 managers of the trigger project that are physicists that are about half time on this task. There are nine Level 2 managers that spend about 20% of their time on administrative and organizations for their projects. All are university physicists. The error estimate is based on the experience so far in mounting the project. 2.7.2 Travel vendor and collaborator visits 10/1/102 3/8/05 \$3,500 \$0 \$0 \$3.500														<u> </u>	
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The management carried out by the Run2b Trigger L2 and L3 project managers and their helpers. This task accounts for maintenance of the schedule, organizing meetings and reviews, maintaining and distrubuting documentation. M&S BOE- no costs associated with this item Labor BOE- There are two L2 managers of the trigger project that are physicists that are about half time on this task. There are nine Level 2 managers that spend about 20% of their time on administrative and organ tasks for their projects. All are univeristy physicists. The error estimate is based on the experience so far in mounting the project. 2.7.2 Travel vendor and collaborator visits 10/1/02 3/8/05 \$3,500 \$0 \$0 \$3,500 \$3,500			-6:-:u:												
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	2.7.2		Resource Name	Units	Cost	Baseline Cost		Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		\$3,500
WBS Definition-	2.7.2		Resource Name	Units	Cost	Baseline Cost		Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		\$3,500

Collaborator visits are needed to make contact with personnel on the projects, examine facilities and production, discuss technical choices, and meet with adminstrators as necessary. Major production of trigger elements will be carried out in Arizona, Boston, New York, and Saclay.

M&S BOE-Saclay: one trip for two people to Saclay at \$1500 per trip.

WBS		Name					Sta	art	Finish	M&S E	3 M&	S Labor	FNAL Labor	Total Cost
'Travel v	endor ar	nd collaborator v	isits" cor	ntinued										
		four trips to Bosto al: \$3500	on, New You	rk, or Arizo	na at \$500 per trip).								
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1.2.7.3		Shipping costs	S				10/1/0	02	3/8/05	\$2,00	0	\$0	\$0	\$2,000
	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work		
	15	MandS	2,000	\$2,000	\$0	\$0	\$2,000	2,000		0	0	2,00	00	
	Costs f M&S B Shippir approx	efinition- or shipping complet		e and prod	uction boards fror	n collaboratinç	g institutions (A	Arizona, Bo	oston, Columbia	a, Sacaly) to Ferm	iilab.			
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